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Article

Conceptualising and Modelling e-Recruitment Process for Enterprises through a Problem Oriented Approach

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Abstract: Internet-led labour market has become so competitive forcing many organisations from different sectors to embrace e-recruitment. However, realising the value of the e-recruitment from a Requirements Engineering (RE) analysis perspective is challenging. This research is motivated by the results of a failed e-recruitment project conducted in military domain which is used as a case study in this research. After reviewing the various challenges faced in that project through a number of related research domains, this research focuses on two major problems which are the (1) difficulty of scoping, representing, and systematically transforming recruitment problem knowledge towards e-recruitment solution specification; and (2) the difficulty of documenting e-recruitment best practices for reuse purposes in an enterprise recruitment environment. In this paper, a Problem-Oriented Conceptual Model (POCM) with a complementary Ontology for Recruitment Problem Definition (Onto-RPD) is proposed to contextualise the various recruitment problem viewpoints from an enterprise perspective and to elaborate those problem viewpoints towards a comprehensive recruitment problem definition. The POCM and Onto-RPD are developed incrementally using action-research conducted on three real case studies: (1) Secureland Army Enlistment, (2) British Army Regular Enlistment, and (3) UK Undergraduate Universities and Colleges Admissions Service (UCAS). They are later evaluated in a focus group study against a set of criteria. The study showed that the POCM and Onto-RPD provide a strong foundation for representing and understanding the e-recruitment problems from different perspectives.

Keywords: enterprise recruitment; problem definition; e-recruitment

1. Introduction

Recruitment is a key strategic opportunity for achieving a competitive advantage over rivals [1,2]. Given that talent is rare, valuable, difficult to imitate, and hard to substitute, organisations that better attract this talent to fill their job vacancies should outperform those that do not [3]. Recruitment is the practice of attracting sufficient numbers of qualified individuals on a timely basis to fill job vacancies with an organisation [4]. It is very important since it is the primary way of influencing the performance and diversity of individuals in an organisation. It ensures the initial high quality abilities of recruits necessary for work performance [5]. It also influences the demographic composition of the workforce to meet the organisation's strategic, legal and social goals [6]. It is regarded as an essential means to influence post-hire employee retention [7].

The internet-driven global labour market combined with many forces, such as a higher educational level of the new generations, strong economic situations and a low unemployment rate, has become very competitive [8,9]. This, in turn, puts a great deal of pressure on organisations from different sectors to change their traditional recruitment practices towards more innovative, high-quality, customised, and timely e-recruitment solutions [9-11]. In the military sector, for instance, the migration from old compulsory military recruitment to an all-volunteer force relying

on labour market has increasingly pushed the military organisations to get into the continuum [8,12,13]. E-recruiting is defined as any recruitment practice that an organisation conducts using web-based solutions [14,15]. Despite the different methods of e-recruiting, web recruiting (i.e. use of corporate web site) is the most commonly used e-recruiting method [4]. E-recruiting can bring value for organisations including being reliable in attracting a diverse and qualified group of job seekers, agile in filling vacancies, cost-effective, rapidly responding to job seekers' changing needs and market opportunities, and flexible in normal and exceptional circumstances [16].

The current maturity of information and communication technologies (ICTs) and the recent developments in design processes enable a relatively simple and reliable transforming of the conventional recruitment practice into e-recruitment solution [13,17]. To be innovative, the focus should be shifted from the e-solution space into the problem space where the desired effects (i.e. requirements) that an organisation wishes to be brought by the e-solution in the recruitment practice exist [18]. With the help of Requirements Engineering (RE), the RE activities of the e-solution must be anchored to the domain knowledge of real-world recruitment problem so that the quality of the e-solution to be delivered can then be analysed [19-22]. This front-end part of RE is called problem definition [23] or problem description [24,25].

Problem definition refers to how problems or concerns are represented: what problem elements should be included, what relationships among these elements are, and how these selections might vary over problem types [23,24]. Such a problem representation is created for structuring problem domain knowledge and orienting it towards RE in a systematic manner [26]. Hence, it offers an established problem definition and serves as a basis for eliciting and reasoning about requirements from different stakeholders perspectives [20,27]. For instance, relevant stakeholders using this representation could be asked to identify the flaw, conflicts, incompatibility, and difficulties that define a problematic situation thereby effectively and efficiently informing complete and consistent requirements. As a result, the problem representation affects the quality of the requirements based on which the e-solution systems are built. It has been argued that if stakeholders do not agree with the choice of problem representation, it is unlikely that they will ever agree with any statement of the requirements [19,24]. These poor requirements largely account for the cancellation of e-solution development projects or the subsequent failure in building a successful e-solution [28,29].

However, in large-scale, trans-national and multi-demographical organisations that are engineering-focused and need reliable and long-lasting e-solutions, it seems that problem definition is very complex and prone to failure [21,26]. This research was originally driven by the challenges faced in realising the value of a real e-recruitment project from the military sector referred to as Secureland Army Enlistment. The project relates to the non-officer enlistment process in the Secureland's Army (SA). Three main challenges that are related to some knowledge gaps in the research literature can be summarised as:

- The difficulty in scoping recruitment problem [30,31];
- The difficulty in representing and understanding of real-world recruitment problem [6,32]; and
- The difficulty in systematically transforming the problem domain knowledge into the specification of e-recruitment [21,22].

The practical problem addressed in this paper is that the ill-representation and understanding of recruitment problem impedes the realisation of the value of e-recruitment. Therefore, the paper proposes a Problem-Oriented Conceptual Model (POCM) for conceptualising and defining recruitment problem root concepts from an enterprise perspective facilitated by an ontology (Onto-RPD) to elaborate these concepts towards a comprehensive recruitment problem definition. During this study, three case studies, including the Secureland Army Enlistment, are analysed, and various problems are identified to develop the conceptual model and the corresponding ontology. This work provides a valuable contribution into the understanding of recruitment problem from different perspectives, and can deliver guidance in a systematic manner to inform the requirements elicitation and analysis towards e-recruitment solutions.

The paper is organised as follows: this section presents an introduction to the research study. The literature review and background information are presented in Section 2. The case studies are explained and analysed in Section 3. Based on these case studies, the POCM and Onto-RPD are proposed in Section 4. The integration of the model into the recruitment RE process and the results are discussed in Section 5. Finally, conclusions are drawn and future work is suggested in Section 6.

2. Recruitment and E-Recruitment

A great deal of research from both Human Resources (HR) and Industrial and Organisational (I/O) psychology domains has been conducted to define recruitment. However, there has been no consensus on its definition. Randall [33] states that recruitment is "the set of activities through which the people and the organisations can select each other based on their own best short and long term interests". This definition highlights recruitment from the perspectives of the two key players: organisation (i.e. employer) and people (i.e. job seekers). However, from an organisation-based perspective, Barber [34] defines recruitment as "the practices and activities carried on by the organisation with the primary purpose of identifying and attracting potential employees". He delineated three phases of recruitment: (a) generating applicants, (b) maintaining applicant status, and (c) influencing job choice decisions.

Breaugh [7] distinguishes between two types of recruitment: internal in which a job applicant is a member of the employing organisation; and external in which a job applicant is not a member of the employing organisation. Internal recruitment is similar to employee promotion and move. However, external recruitment is defined as the organisational activities that are intended to: (a) bring a job opening to the attention of potential job candidates who do not currently work for the organisation; (b) influence the number and/or the types of applicants to apply for the job opening; (c) influence their interest in the position to stay until a job offer is extended; and (d) influence their interest to accept a job offer [7]. Likewise, Rynes [35] states that recruitment is the activities designed to influence the number and type of applicants who apply for a job and accept job offers. Another definition stressing timing is the practice of attracting sufficient numbers of qualified individuals on a timely basis to fill job vacancies with an organisation [4].

Saks [30] describes recruitment as "the set of actions and activities taken by an organisation in order to identify and attract individuals to the organisation who have the capabilities to help the organisation realising its strategic objectives." This definition implicitly combines the activity of selection in which the capabilities and qualifications of individuals are evaluated against who apparently owns those capabilities that help the organisation in realising its strategic objectives. In contrast to this, Gatewood et al. [6] defines another type of recruitment called hiring. Hiring refers to the type of employment in which job offers are extended with no evaluation of the applicant's capabilities and qualifications [6]. This is often carried out when an organisation desperately needs applicants to fill unskilled or semi-skilled positions within a limited time.

Looking to recruitment from a broad sense, Philips and Gully [36] define strategic recruitment as "the practices that are connected across the various level of analysis and aligned with firm goals, strategies, context, and characteristics." They suggest that strategic recruitment overlaps with four complex disciplines: Resource-Based Theory (RBT); Strategic Human Resources Management (SHRM); Human Capital; and levels of analysis [36]. The work of Philips and Gully [36] highlights the need to extend the focus on recruitment from a higher level of analysis as same as the SHRM approach.

The review of the abovementioned recruitment definitions [4,6,30,31,33-36] gives insights into the common and divergent characteristics of recruitment as follows:

- It involves specific activities and actions that are undertaken to achieve particular outcomes;
- It indicates the importance of generating a pool of applicants with desirable capabilities;
- It addresses the interest of relevant stakeholders such as organisation and applicant to fill vacancies;

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- It addresses the need to increase the probability that applicants will apply, stay, and accept a job offer;
- It indicates the overlap between recruitment and the selection activity by acknowledging that those persons who are attracted to the organisation might/might not have the capabilities desired. Hence, it is the purpose of selection to determine whether applicants have the required capabilities;
- It distinguishes between internal and external recruitment;
- It distinguishes between recruitment and hiring;
- It indicates the overlap between pre-hire outcomes of recruitment (e.g. filling vacancies by the qualified applicants) and post-hire outcomes (e.g. employee retention and work performance).
- It asserts the strategic focus on recruitment thereby making it clear that recruitment can and should play an important role in helping an organisation achieve its strategic objectives.

In this research, we focus on recruitment as enterprise and analysis of different interests from different enterprise stakeholders' perspectives. We accept that the activity of selection is included within recruitment. In addition, we focus on external recruitment rather than internal one; recruitment rather than hiring; and pre-hire outcomes rather than post-hire outcomes.

E-recruitment is defined as the use of the internet to attract potential employees to an organisation and hire them [37]. Dhamija [38] describes e-recruitment as "the practice whereby the online technology is used particularly websites as a means of attracting, assessing, interviewing, and hiring personnel." E-recruitment could be defined as any recruiting process that an organisation conducts using Web-based tools [14,15,]. There are some common methods of e-recruitment. First method is Web recruiting (use of the organisation's Web site) is the most commonly used e-recruiting method [4,37]. A survey conducted in 2003 shows that 92% of Fortune 500 companies had career web sites [39]. Another survey conducted by Lee [40] demonstrated that among Fortune 100 corporations, 94% have owned career web sites. The use of this method will continue to increase [31]. The second method is the use of internet job boards [41,42] where organisations rely upon third-party recruiters (e.g. CareerBuilder.com, Monster.com, and HotJobs.com). The third is social media recruitment [43].

Despite the contributions of these recruitment methods are varied, the common advantages that e-recruitment can offer are: savings in time, money, and resources; the outreach potentiality to a diverse broader group of job seekers; establishing a brand identity; more communicative and adaptive to job seekers' changing needs and market opportunities, better service and applicant satisfaction; and more flexible in normal and exceptional circumstances [4,16].

Recruitment is a foundational input of organisational effectiveness [5,36,44]. Competitive advantage is rooted in the individual and organisational capabilities that are leveraged for strategic execution [2]. Since recruitment influences these capabilities so that it is a key source of competitive advantage [36]. Recruitment is the first entrance to influence the characteristics and quality of new employees [5]. It has also implications for all other human resources activities [6]. For example, the type of applicants attracted has implications for selection and training activities.

The e-recruitment has made a new competitive environment for organisations to rethink and adapt technology to increase effectiveness and efficiency of recruitment practice. Combined with various challenges such as the increased importance of human capital, the increased level of qualifications with new generations, strong economic situations, and less unemployment rates [8,16], recruitment has been marked as a top priority [30,43]. Research has offered evidence about the rationale behind this increased interest in e-recruitment. First, the passive recruitment which implies people to make themselves available to employers has outmoded. This may account for why many organisations have been experienced substantive crisis in attracting high-quality employees [4]. Second, Scheweyer [45] reports that the demand of e-recruitment has been rapidly increasing due to the competitive advantages it offers. This, in turn, has put a great deal of pressure on organisations to shift into e-recruitment [9-11]. Third, e-recruitment allows job seeker to be more selective in their

job choices which increasingly forces organisations to adopt more innovative ways to satisfy their needs [43].

2.1 Problem-Oriented RE and Problem Definition

The concept of problem is central in research on systems and software engineering [24]. More broadly, it presents in every study requires action-oriented thought [23]. Despite this centrality and its widespread use, it is still not clearly defined. Osigweh [46] states that problem is a vague concept: the more a word of 'problem' is used for everything, the less we know what it means. One common definition is that it is a gap, difference, or disparity between what is and what might/should be [23,47]. Another definition of Agre [48] is that a problem is an undesirable situation that is significant to and may be solvable by some agent, although probably with difficulty. According to Landry [47], the key characteristics of the presence of problem can be concluded as follows:

- Problem is an unsatisfactory situation.
- The existence of gap between preferences and reality.
- The importance of closing this gap (i.e. solution).
- The expected difficulty or uncertainty arising from where the means to close the gap are, either not obvious or not immediately available.
- A sense of minimal control (e.g. available resources) over situation or event.
- Problem has an owner/solver.
- Problem changes over time.
- Problem has a boundary.
- Interrelated with another construct "opportunity" which draws attention to potential goods, instigating thoughtful problem solving activity.

Given that requirements defines a problem, RE can carry various synonyms terms such as problem analysis [49], requirements analysis [50,51], or problem domain analysis [18]. Davis [49] defines the term problem analysis as the activity that encompasses learning about the problem to be solved, understanding the needs of potential users, trying to find out who the user really is, and understanding all the constraints on the solution. However, according to Kotonya and Sommerville [52], problem analysis cannot rely only on learning the details of a specific problem that requires some kind of systems solution. Instead, it requires a focus on understanding the problem domain, including business context and stakeholders' needs, which necessitates an extensive elicitation task. Therefore, Kovitz [50] defines the term requirements analysis as learning the problem and the problem domain from the customer, and communicating this information to the rest of the development staff by writing a requirements document. A quite similar definition of Kovitz [50] comes from Bray [18] referred to as problem domain analysis. Bray [18] defines it as the achievement of understanding problem domain and the documentation of the characteristics of that domain and the problems (requiring solution) that exist within that domain. According to Wieringa [53], if RE is to define a problem, then requirements should describe what the problematic phenomena are, what the causal relationships between these phenomena are, by which norms these phenomena are problematic, and which stakeholders have these norms. From a common sense, it can be said that all aforementioned definitions obviously serve to introduce the concept of RE as problem definition, learning about problem domain and finding out what the problems to be solved are.

A problem-oriented view of RE namely problem definition refers to how problems or concerns are represented: what problem elements should be included, what relationships among these elements are, and how these selections might vary over problem types [24,54]. Such a problem representation is created for structuring problem domain knowledge and orienting it towards RE in a systematic manner [22,26]. Hence, it offers an established problem definition and serves as a basis for eliciting and reasoning about requirements from different stakeholders perspectives [22,27]. Given the complexity of a real-world problem, there is no representation model by which the

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various elements that constitute a problem can be comprehensively included [55]. Hence, each model has some advantages and limitations.

One key example of these approaches is goal modelling [56]. Goal modelling is based on the premise that in collaborative work situations, people are aware of and share common goals and act towards their fulfilment [26]. Hence, the problems associated with business structure, resources, processes, and their supporting systems that inhibit the achievement of these goals can be defined [56]. However, a real-world problem concerns the goals of humans which is not simple to model for several reasons: (a) they are not known in advance; (b) they are often abstract and imprecise and can evolve during the life of a project; and (c) the means that lead to goal achievement are not known beforehand. Another example is the problem frames [24], in which frequently occurring problem structures are identified and related to a problem frame. This frame captures the characteristics and relationships of the parts of the world it is concerned with, and the concerns and difficulties that are likely to arise. This helps to focus on the problem space instead of moving into the solution space. However, it is criticised being limited in scope focusing on the objective aspects of software problems [57].

A third problem representation technique is Enterprise Architecture (EA). The concept of EA has evolved to address two key problems [58]. The first problem is to manage the increasing complexity and change in IT systems [59]. The second problem is the increasing difficulty in realising business value with those systems [58]. To solve these key problems, a bundle of EA reference frameworks were proposed. According to Roger [58], the most leading ones are Zachman Framework [27], The Open Groups Architecture Framework (TOGAF), and Federal Enterprise Architecture (FEA). According to Zachman [59], today's information age with the increased complexity and change in the global market needs a holistic view that address the wide range of business requirements rather than just focusing upon technical solutions. Hence, it is not an IT issue [59-61]; however, it is a problem definition issue [18,53,59]. According to Zachman [59], an EA, therefore, needs a structure (i.e. representation) that establishes a reference of problem definition and guides the transformation process (i.e. methodology) towards the solution. Without such a structure, transformation processes will be ad hoc, fixed and dependent on practitioner skills [59].

Despite the insights given by the Zachman's framework (i.e. the importance of problem representation), the framework has some limitations in regard to the recruitment research problem. First, the framework lacks a step-by-step supportive process for enterprise engineering [58]. The framework is a structure (i.e. problem representation) and not a transformation process [27]. Second, the framework builds on the argument that the conventional architecture representations of the manufacturing and constructions can be analogously applied into a complex real-world problem (e.g. recruitment). According to Gaver [62], this conceptual argument is faulty and incomplete. In general, a real-world problem is not an ordinary system, such as a machine or a building, to be structured and engineered. In particular, recruitment problem has many social and subtle features that cannot be easily represented in a reduced form as same as that of the Zachman's framework. These social features are often neglected or trivialised [63].

2.2 *Representation of the Recruitment Problem*

From the cognitive view, problems are conceptual entities that do not exist in the world, but they must be externalised (i.e. expressed) so represented towards solution-oriented thought [23,54]. Problem representation enables problem domain knowledge which is, in turn, very crucially important in problem solving [20,22]. This task is very difficult for a real-world problem due to the various aspects that constitute it [21,24,26,64]. Hence, there is no reference model by which all these various aspects can be comprehensively represented [55,65]. Therefore, recruitment problem can be expressed by a chosen representation that is somehow grounded in reality; agreed on by all stakeholders; and best suited for problem solving [47,64]. However, there are many criteria that have been proposed for assessing the quality of such representation such as validity and generativity [23,65]; abstraction [20,66]; viewpoints [66]; and expressiveness and communicativeness [65]. However, the quality varies based on many aspects of real-world problem such as the context and

complexity of a real-world problem, the type of business, the type of project, the feature of analysis [66-68].

There are a number of descriptive and prescriptive recruitment models proposed for conceptualising recruitment problem. The most cited ones are Rynes's [69] model for future recruitment research, Saks's [30] dual-stage model of the recruitment process, and Breaugh and Starke's [7] model for the organisational recruitment process. While these models address some aspects of recruitment problems, they are strongly solution-oriented, focusing on what and how rather than why. Ployhart [32] (p. 869) comments on the research-practice gap of recruitment saying "it seems organisational decision makers do not understand staffing (recruitment) or use it optimally." We believe that because recruitment problem has never been completely represented, it has never been correctly understood. In this regard, it has been widely reported that when stakeholders ask for new features or capability, they quite often state their needs as an implementation (i.e. solution-based) [57,70].

It has been widely suggested that a better representation of the recruitment problem should rely in the first instance on an appreciation of its complexity [5,7,30,32]. This complexity stems from a set of cognitive, social and organisational variables involved and the nature of their relationships [7,31,34].

This paper proposes an established conceptualisation of recruitment problem that describes the various problem elements and their relationships, and shows how these problem concepts might vary over different types of recruitment problems. Hence, the depiction of the constituent elements of recruitment problem and their overlapping relationships is the essence of the representation of recruitment problem. This representation will help closing the knowledge gap in different ways. It will support delaying of solution consideration until a good understanding of the problem space is gained. It will also provide a means of analysing and decomposing problems into simpler sub-problems that can be readily addressed. It will also help stakeholders to capture and share the necessary problem domain knowledge, and this will be driven into the negotiation over trade-offs and consideration of details of the solution support.

3. Research Methodology

The research approach used in this study is design science. According to Hevner et al. [71], design science creates new artefacts for solving practical problems. These artefacts can be methods, models, constructs, frameworks, prototypes or IT systems, which are introduced into the world to make it different, to make it better [72]. Design science is, therefore, the process to generate these artefacts and test hypotheses about them, i.e., artefacts that can, when introduced, solve problems for a practice and change its future behaviour [73]. Hence, the solution needs to be evaluated to assess its ability to solve a practical problem as well as to fulfil stated requirements [71]. In the literature, different strategies and approaches have been presented for design science processes and conducting solution assessment [71,72,74-76]. The design science research process carried out in this research includes five research activities as defined by the design science method framework of [72]. These activities and their application are presented below.

3.1 Problem Explication

The first activity in the design science process is to explicate the practical problem that motivates why the artefacts (i.e. in this case, the POCM (Problem-Oriented Conceptual Model) and Onto-RPD (Ontology for Recruitment Problem Definition) need to be designed and developed. To explicate this, a number of research activities and methods are used. First is the extensive review of the SA e-enlistment project using document inspection to identify the various challenges that led to the failure of that project. Second, in relation to those challenges, the literature related to recruitment, e-recruitment, problem definition and representation approaches are reviewed to identify the central issues and knowledge gaps in recruitment research. Third, a number of problem representation approaches are applied in practice to the SA enlistment case study to reflect and validate those issues

and gaps. After the extensive analysis, two problems, among others, are defined as root causes of the failure in the SA e-enlistment project.

The first problem is "the ill-defined scope of recruitment problem space." The related knowledge gap that motivates the research to fill is that "there is a lack of knowledge about enterprise recruitment problem." The second problem is "the ill-representation and understanding of recruitment problem." which impedes the realisation of the value of e-recruitment. The knowledge gap related to this sub-problem is that "there is a lack of knowledge about how recruitment problem is best represented." Hence, the abovementioned artefacts are designed to solve this problem.

3.2 *Requirements Definition*

The second activity in the design science process is to define the requirements of the POCM and Onto-RPD. These requirements will be used as a basis to evaluate the resulting artefacts and also to guide the construction process of them and any refinement steps. Based on the literature review, the following requirements are selected:

- *R1. The artefact(s) should be comprehensive:* Comprehensiveness is the degree to which the artefact(s) offers complete knowledge [77,20]. According to Burton-Jones et al. [78], comprehensiveness means the percentage of concepts in the artefact relative to the average for the entire library of concepts in the domain of interest. Osada et al. [66] refer to this as the amount of suitable information included in the artefact. This amount should be large enough and suitable for complete knowledge. However, too huge amount of knowledge is confusing and hard to deal with [66]. For this requirement, in the artefact of the POCM, we refer to the knowledge of problems, sub-problems, and relationships. However, in Onto-RPD, we refer to the knowledge of the various concepts and features related to the problems defined in the POCM.
- *R2. The artefact(s) should be generic:* Genericity is the degree to which the artefact(s) is shared and sector/domain-independent [77]. The artefact(s) should be shared between diverse stakeholders and activities [77]. Sector or domain independence means that the artefact is not specific to a sector/domain [79,80]. Achieving this requirement facilitates capturing, transfer, and reuse of domain knowledge from different domains [81]. Both the POCM and Onto-RPD shall not require practitioners to be familiar with the sector or domain in which a recruitment practice is applied.
- *R3. The artefact(s) should be consistent:* Consistency is the degree to which the artefact(s) has correct and accurate definitions compared to the existing domain knowledge [66,77]. It can be also defined as the degree to which the artefact(s) constitute a coherent unit, i.e. all parts are clearly related [79].
- *R4. The artefact(s) should be abstract/granular:* Abstraction or granularity is the degree to which the artefact(s) represents a core set of primitives that are partitionable in different levels [20,66,77]. Abstraction is one of the most important criteria in evaluating the representations (i.e. artefacts) of domain knowledge [66].
- *R5. The artefact(s) should be perspicacious/generative:* Perspicacity or generativity is the degree to which the artefact(s) is easily understood by the practitioners so that it can be consistently applied and interpreted across the enterprise [77,78,82]. It is also defined as the ability of the artefact to promote effective decision making or judgement towards problem solving [23]. From a RE perspective, it is defined as the ability of the artefact to promote effective requirements elicitation [57,70].
- *R6. The artefact(s) should be minimal:* Minimality is the degree to which the artefact(s) contains the minimum number of objects (i.e. terms or vocabulary) necessary [77,83].
- *R7. The artefact(s) should be precise:* Precision is the degree to which the artefact(s) has correct and accurate definitions compared to the existing domain knowledge [66,77].

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3.3 Design and Development

The third activity is to design and develop the artefacts that address the explicated problem and fulfils the defined requirements. The POCM and Onto-RPD are jointly designed and developed using Action-Research (A-R) [84] through the plan, act, observe, and reflect activities. The design and development activities are explained in Section 4.

3.4 Demonstration and Evaluation

This activity is to use and assess how well the artefacts solve the practical problem taking into account the previously identified requirements. In the demonstration phase, the POCM and its corresponding Onto-RPD artefacts are used in real-life cases to prove their feasibility. In the evaluation phase, the POCM and Onto-RPD are investigated whether they solved the problem of research identified and fulfilled the defined requirements. The two phases, demonstration and evaluation, were conducted using a focus group of experts from heterogeneous recruitment-related domains over two sessions, one session for each phase. The demonstration and evaluation activities are explained and the results are presented in Section 5.

3.5 Research Methods

This section describes the various research methods selected for developing the POCM and Onto-RPD artefacts and the rationale behind this selection. Figure 1 summarizes which research methods are used during different stages of this research study.

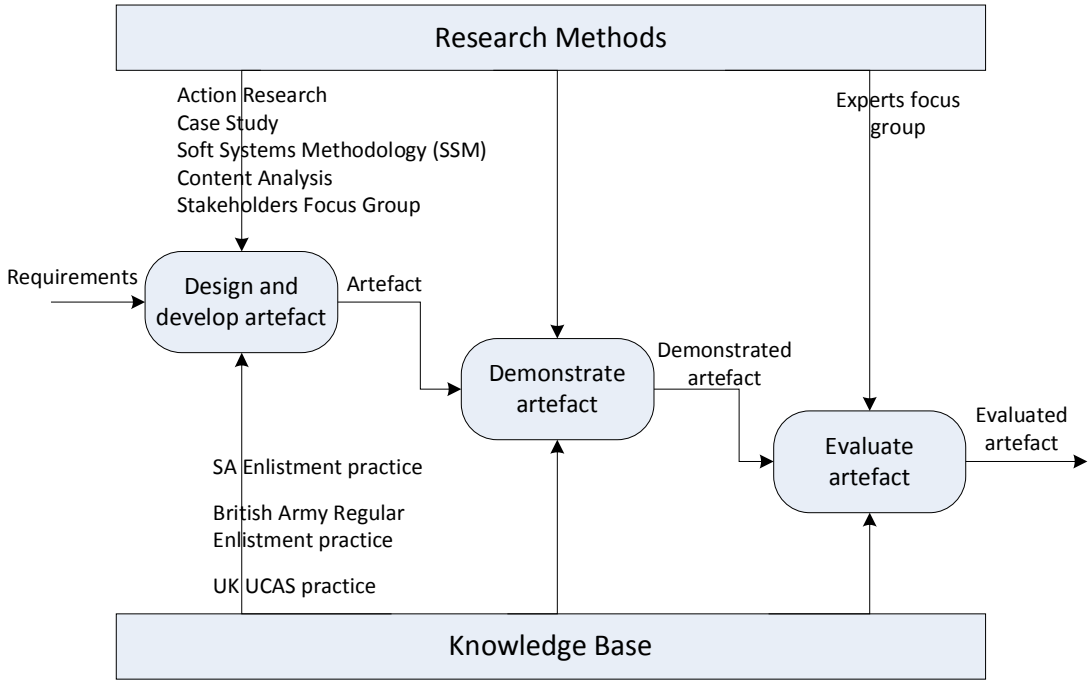

Figure 1. Research methods used during design, develop, demonstrate and evaluate artefact phases.

3.5.1 Action-Research Method

A-R is a spiral process that allows action (change and improvement) and research (understanding and knowledge) to be achieved at the same time [84]. It emphasises collaboration between researchers and practitioners, and supports the practical problem solving as well as the theoretical knowledge generation [84]. It has much potential for the information systems field being a useful qualitative research method [85]. In regard to using it within the design science framework adopted in this research, there is a growing consensus relates to the similarity between A-R and design science (DS) [86,87]. Järvinen [86] compared the two methods and found that they are similar

along a string of important parameters. He suggested A-R being more closely combined with DS rather than necessarily seeing it as qualitative research per se. He argued that although DS may be seen as a research method that has been practiced within engineering and natural science, the combination would improve the quality of research by combining between relevance and rigor [86]. According to Wieringa and Morali [87], DS research has established itself as an acceptable approach to information systems research being combining a problem-solving cycle with a theory-building cycle. To facilitate such combination, Baskerville et al. [88] integrated both A-R and DS with Checkland's Soft Systems Methodology (SMM) and developed a new approach called soft design science research. Inspired by the work of Baskerville et al. [88], this work integrates A-R, DS, and SSM in building the POCM and Onto-RPD artefacts.

3.5.2 Case Study

The research was established upon the case study of SA enlistment practice and developed by using two other case studies (BA enlistment case study and UCAS case study). The study was driven by the failure in realising the value of the SA's e-enlistment project with the objective of investigating the various recruitment problem concepts faced in that project and refine them with the concepts derived from the other two case studies. The type of case studies is exploratory which is particularly suited to the type of qualitative knowledge available with regards to this research [89]. This type of case study is also used to explore those situations in which the intervention being evaluated has no clear, single set of outcomes [89].

According to Yin [89], a case study method should be considered when: the focus of the study is to answer "how" and "why" questions; no or little control over the behaviour of those involved in the study; various contextual conditions are relevant to the phenomenon under study; or the boundaries are not clear between the phenomenon and context. Likewise, the objective of this research is to understand why it is challenging to realise the value of SA's e-enlistment project and how these challenges can be confronted. In addition, little control over those involved in the study and related events is available, and various contextual issues and less clear boundaries between the phenomenon and context exist. Case studies are relatively important when extracting the necessary information and evaluating the artefacts developed. The artefacts were developed and refined through the extraction of some instances from different case studies. A list of features that makes the case studies appropriate is derived to guide the decision on case study selection.

3.5.3 Literature Review

The literature review is an essential part of an academic research project. The review is a careful examination of a body of literature pointing toward the answer to the research question. The purpose of the literature review is to test the research question against what already is known about a certain subject. A good literature review will look at the research that has been done and synthesize or pull together those elements that are similar or most pertinent to the theme that has been chosen. For the purpose of this research, the literature reviewed assisted in investigating the research gaps and central issues in recruitment domain in relation to the failure in SA e-enlistment. In this context, the literature related to problem definition, problem representation, enterprise architecture, requirement engineering, and best practices documentation and reuse was all reviewed. Another use of literature review method was to define the various requirements based on which the POCM and Onto-RPD were designed.

3.5.4 Document Inspection

In most cases, a significant amount of data that helps locating the problem is embedded in documents. Furthermore, the initial information captured by document inspection method often form the basis on which further research methods are selected. This method was intensively used to capture knowledge about the SA e-enlistment project, including the mission and functions of SA, the SA's organisational structure and recruitment types, the e-government vision and strategic goals of

Secureland and the SA, previous work conducted on the SA e-enlistment project, and the challenges faced in that project. It was also the main data source for building the models for the SA enlistment practices (pre-2008 and post-2008) in pursuit of explicating the research problem.

3.5.5 Focus Group

Focus group is a research method used for idea generation or validation where several informed participants share their point of view on a specific topic or problem. It can generate a broader range of information, and deepen understanding of the topic under discussion. It can be also used for validating and verifying the results gained from other research methods. The usefulness of this method lies in: the ability of interviewing a large number of participants at one specific time thereby saving much time and cost; and the elicitation of information and data from different people perspectives. In this research, two focus groups were used in different stages. The first one was in the "design and develop" phase. The second focus group was used during the phase of "demonstrate and evaluate artefact" to evaluate the POCM and Onto-RPD against the set of requirements defined in the "define requirements".

4. Development of POCM and Onto-RPD

The development of POCM and Onto-RPD artefacts undergoes through three A-R cycles. In each A-R cycle, a specific case study is used with a set of research methods for analysis. The artefacts were not simply developed by a matter of consolidating partial vocabularies from the literature, but through bottom-up analysis of data using many techniques associated with the development of grounded theory.

The first A-R cycle is initiated by the analysis of the SA enlistment case study using the Checkland's Soft Systems Methodology (SSM) [90] as an approach (i.e. research framework): (1) to capture the different worldviews of enterprise recruitment problem, (2) to develop the root problem definitions and the multiple entities (i.e. participating roles) in enterprise recruitment, and finally (3) to develop the first tentative POCM and Onto-RPD artefacts. The first version of the POCM and early outputs of this research were presented in previous publications of the Authors [16,91]. Different problem analysis techniques such as Rich Pictures, CATWOE, 5 Whys, and Cause-Effect analysis were used at this cycle. That version was later refined and supported by a corresponding Onto-RPD for more elaboration using text analysis from the other case studies. In the second A-R cycle, the BA enlistment case study is analysed using content/text analysis to capture the various root recruitment problem concepts. These resulting concepts are used to refine the first tentative POCM and Onto-RPD artefacts. The refined version of the POCM was and Onto-RPD presented in [92]. Similarly, the third A-R cycle is to analyse and extract the concepts from the UCAS case study to refine the second tentative POCM and Onto-RPD created in the second A-R cycle. To extract recruitment problem concepts during all A-R cycles, different problem analysis techniques and encapsulation guidelines are used. Figure 2 illustrates the incremental process of building the POCM and Onto-RPD.

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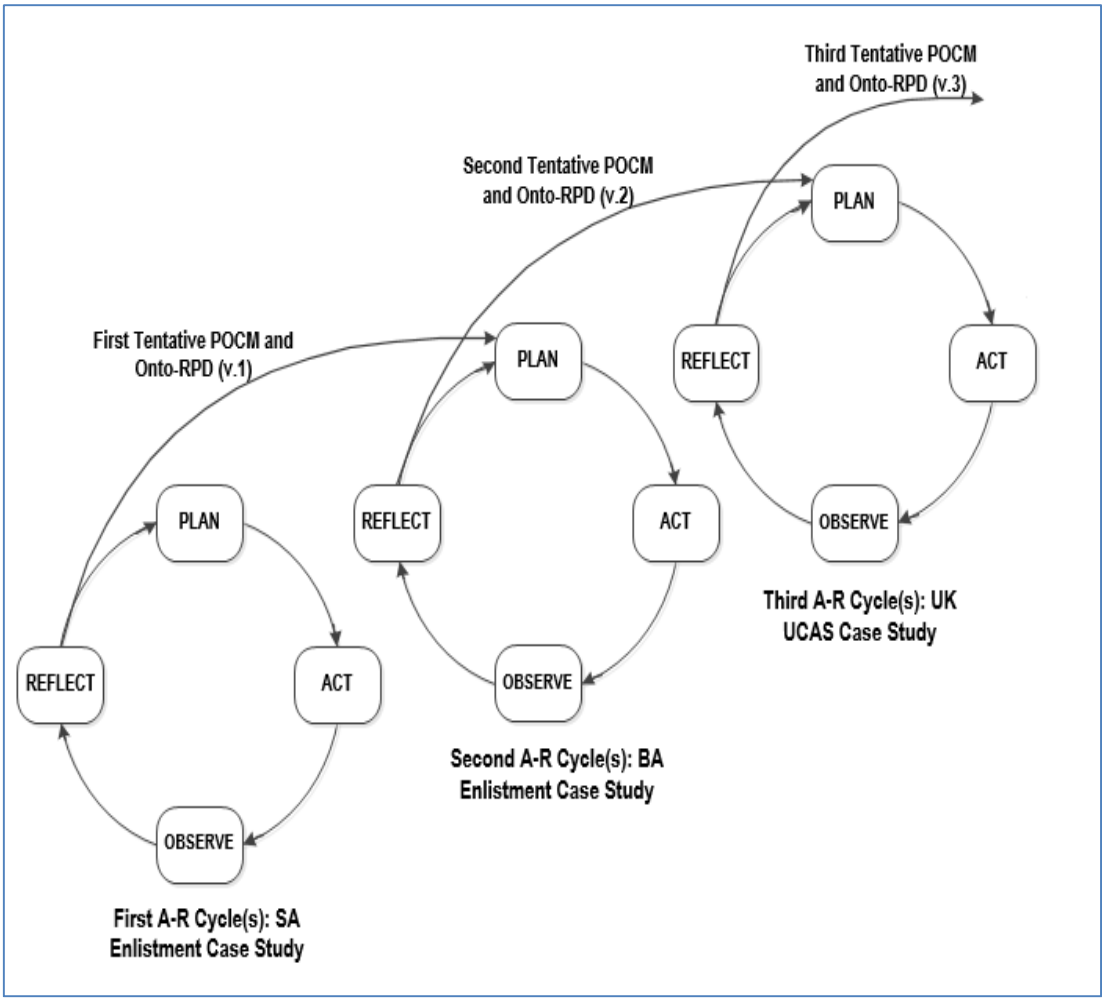

Figure 2. The process of artefact development.

The final improved versions of POCM, Onto-RPD, and root problem definitions are presented in this article. The methodological framework for exploring, capturing, and abstracting recruitment problem, and building the POCM and Onto-RPD artefacts is presented in Figure 3. The framework is inspired by Soft Systems Methodology (SSM) as an approach to understand and explore recruitment problem as a learning system [64]. SSM, a well-known methodology, provides principles, techniques, and guidelines to capture the various system worldviews in a problematic situation, and then develop purposeful activity models (each built to encapsulate a single worldview) as intellectual devices for learning and intervention [90]. According to Checkland and Poulter [64], these principles, techniques, and guidelines of SSM can be both adopted and adapted for use in any real situation.

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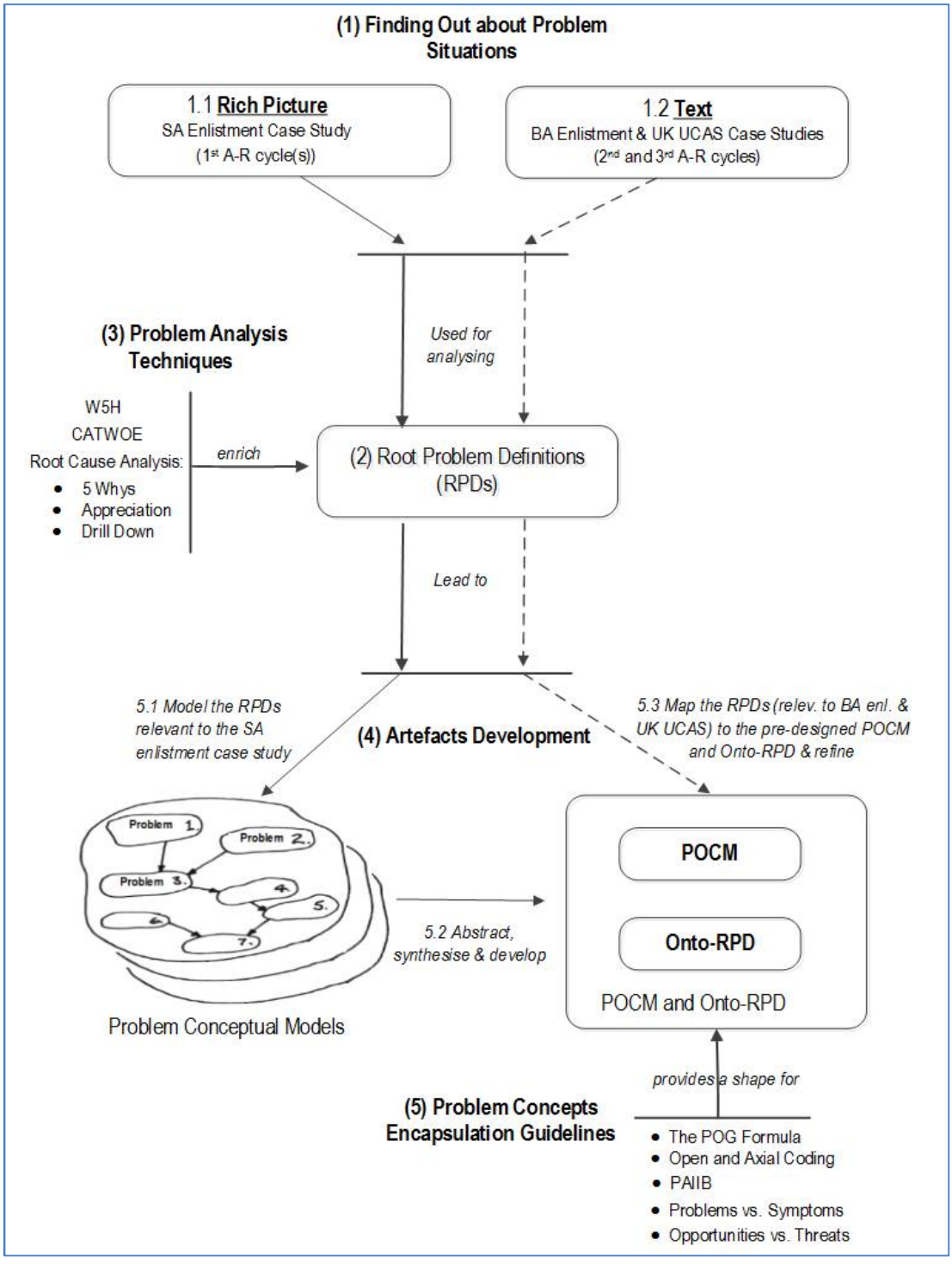

Figure 3. The methodological framework for building POCM and Onto-RPD artefacts.

The POCM is a high-level Problem-Oriented Conceptual Model derived from the various root problem definitions (RPDs) captured from the analysis of the three case studies. The constructs comprising the POCM are the most common problem abstractions and their relationships that often appear in a recruitment problem represented in reference to the proposed definition of recruitment adopted. On the other hand, the Onto-RPD is a complementary ontology that conceptualises the whole recruitment problem space and that helps understanding and defining a recruitment problem. The process of building these two artefacts is evolutionary through the analysis of the case studies selected. The final (output of the third cycle) POCM which is produced from all case studies

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is illustrated in Figure 4. The problem types extracted from the three case studies to develop the conceptual model are explained in Table 1. The ontology of recruitment problem definition is given in Figure 5. Some of the selected definitions of root problem concepts within the POCM and Onto-RPD are provided in Table 2.

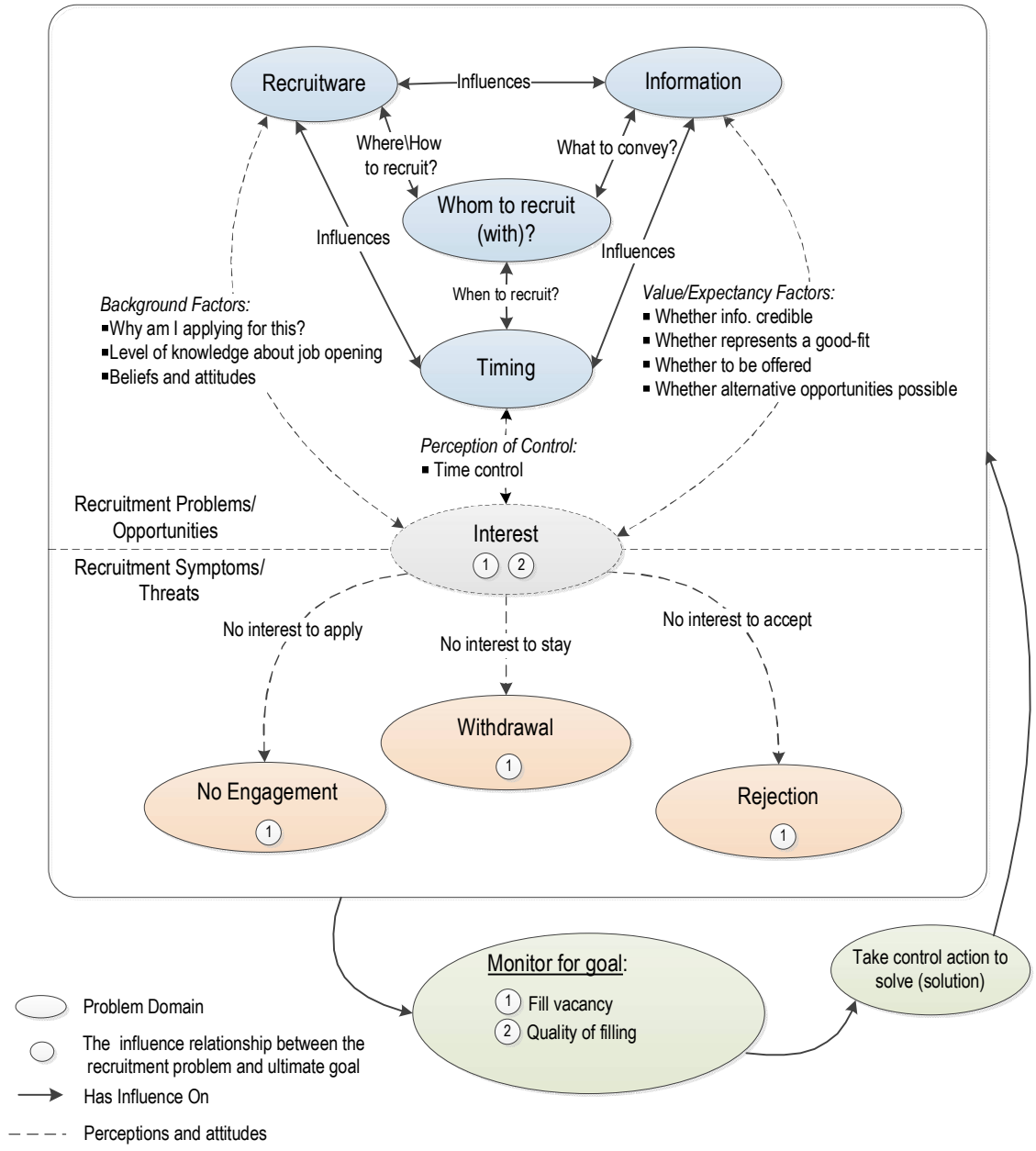

Figure 4. Problem-oriented conceptual model (POCM) for recruitment problem.

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549 **Table 1.** Mapping the types of problems from different case studies into the POCM.

Category	SA Case Study	BA Case Study	UCAS Case Study
Recruitware - Information	Paper-based announcement restricts availability of information	Less visibility of armed forces needs much information be disclosed	Different tools with different modes of information delivery
Recruitware - Whom to recruit	Job locations are remote from local applicants	We try to minimise the impact of mobility on applicants	Improved reach of UCAS services across social classes
Recruitware - Timing	Hard to build a strong relationship in a short time	Loss of timely support needed by other partners	Possible adjustment after exam results (Adjust service)
Timing - Information	Less time to explore job opportunities	Successive provision of job characteristics offered during recruitment process	Up-to-date information, advice and guidance (IAG)
Whom to recruit - Information	High probability of being offered undesired job because of diversity considerations	Some information that might persuade potential recruits to enlisting is not routinely volunteered	Undesirable divide between those applicants who receive effective advice and those who do not
Whom to recruit - Timing	Extra time must be available for remote applicants	Ongoing marketing campaigns for different categories of applicant	Predefined deadlines for different applicants to apply and reply
Information - Interest	Only those who are well-informed about the army and its structure can predict the location of job	The terms of service are extremely confusing and subject to many probabilities	Clear entry requirements promote accurate expectation
Recruitware - Interest	Conceived interest in defending the country needs to be met by reliable enlisting practices	Negative publicity from Afghanistan and Iraq might not persuade potential recruits to enlisting	Apply with 5 course options
Timing - Interest	Post-result recruitment does not allow much time to decide	Career appeals progressively less as potential recruits grow into adulthood	Many applicants were happy with pre-result application (using predicted grades)

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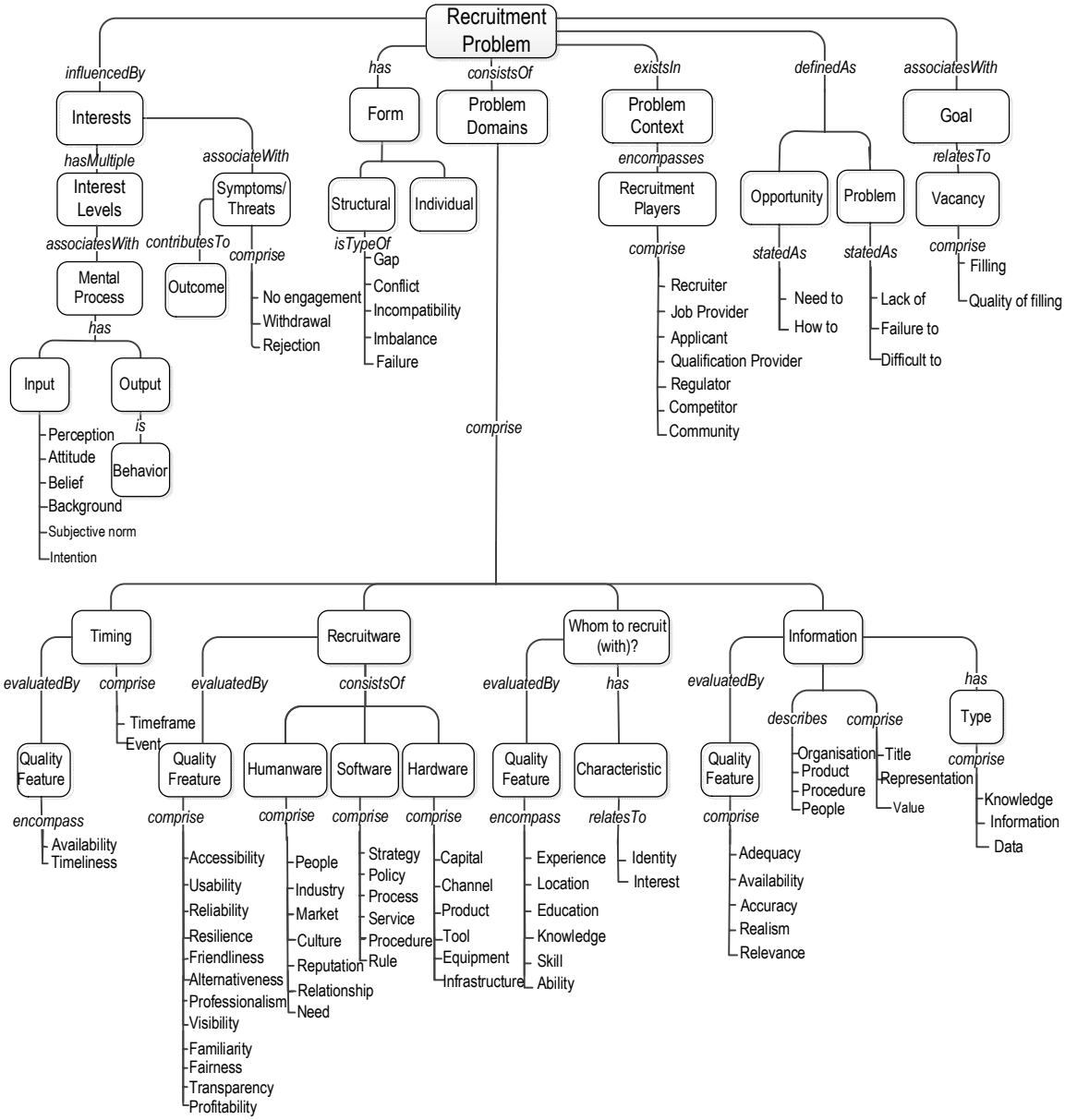

Figure 5. The ontology of recruitment problem definition (Onto-RPD).

562 **Table 2.** Selected definitions of root problem concepts within the POCM and Onto-RPD artefacts.

Terms	Definitions
Applicant	A person who is being considered for a job at an organization.
Hardware	A general term that includes all physical elements (i.e. physical assets) used or produced by a recruitment actor that can be seen, touched, and controlled.
Humanware	A general term that includes all human-related aspects that describe a recruitment actor and influence the use of hardware and software.
Information	Described as a problem owned by all recruitment actors in which: their information revealed through controllable and non-controllable communication fail to/need to influence the others' interests assessed by a set of quality features (e.g. availability, adequacy, relevance, etc.) taking into account all influences of other problem domains. This problem domain can be referred to as Communicated Identity.
Interest	Described as a problem owned by all recruitment actors in which: they perceive that recruitware, information, and timing fall short to influence the intentions to react positively assessed by a set of factors (e.g. value/expectancy and background factors). This problem domain can be referred to as Conceived Identity.
Rejection / Withdrawal / no engagement	Described as problem owned by all recruitment actors in which their behaviours/actions influence filling of vacancy. No engagement is when there is no action carried out by the actor; withdrawal is when the actor withdraw out of interaction); and rejection is when the actor send an actual rejection message to an offer.
Problem Context	The area in which a problem exists.
Problem Domain	A way of considering or conceptualising problem.
Quality Feature	A distinctive attribute or characteristic possessed by someone or something.
Recruitment	An enterprise system in which different players interact according to their interests to fill a job vacancy.
Recruitment Problem	A problematic situation with a recruitment practice regarded as undesired that needs to be defined to overcome.
Recruitware	Described as a problem owned by all recruitment actors in which: their current attributes, shaped by a number of elements, fail to/need to influence the others' interests assessed by a set of quality features taking into account the impact of the other problem domains. This problem domain can be referred to as Actual Identity.
Timing	Described as a problem owned by all recruitment actors in which: the timings of events fail to/need to influence the others' interests assessed by a set of quality features (e.g. availability, responsiveness, timeliness, etc.) taking into account all influences of other problem domains. This can be referred to as Timed Identity.
Whom to recruit (with)	Described as a problem owned by all recruitment actors in which their decisions in regard to the optimum recruitment partner to recruit with to fill a specific vacancy influence/influenced by recruitware, information, and timing taken into account the external factors e.g. social, economic, political, technological, legal, etc.

5. Demonstration and Evaluation of POCM and Onto-RPD

In this section, the demonstration and evaluation of the POCM and Onto-RPD are presented.

5.1 Demonstration

In the demonstration phase, the POCM and its corresponding Onto-RPD artefacts are used in real-life cases to prove their feasibility. The evaluation phase is an important part to examine how well the POCM and Onto-RPD have contributed to address the practical problems explicated and whether they have achieved the defined requirements. The two phases are conducted using one focus group through two sessions.

The participants were selected from Bournemouth University (academic and practitioners) and they had different recruitment-related experiences (e.g. HR, management, marketing, psychology, sociology, etc.). The participants were identified using BU staff database and an invitation poster based on the following conditions: participants should have at least 3 years of recruitment-relevant experience and they should be either an academic expert (teaching staff or PhD students) or a practitioner. After a careful survey of Bournemouth staff database, potential participants were selected according to the expertise in recruitment. After the selection, they were invited using email to participate in research with a chance of winning a 20 Pound voucher from Amazon. The poster was supported with a chance of winning the voucher as well. The poster was distributed through the boards around the public places at Bournemouth University. The purpose of the poster was to widen participation and gain access to those cannot be reached through the BU staff database.

The number of selected participants through the poster was 9 while the number of those selected through the BU staff database was 54. The total number of target participants was 63. A group of 16 people accepted the invitation. The participants were then requested, as an assignment, to write a short description of a recruitment problem case they faced. Only four problem cases were collected. These cases were then revised and circulated to others being asked to comment on them and define the potential problems with each case from their perspectives. The answers were collected and prepared for use in the evaluation phase.

The demonstration session started by welcoming the participants and subsequently a number of activities were conducted towards the achievement of session purpose. The themes of research; the artefacts to be evaluated; the way by which this focus group research is conducted; the way the research materials (templates) are used for answers and comments; and the four recruitment case studies to be used in assessment were presented.

The purpose of this session was to demonstrate the POCM and Onto-RPD artefacts to the participants and apply them to the recruitment cases described in the preparation phase to assess their feasibility. Based on that, the participants were asked to loudly elaborate on each case study (i.e. defining related potential problems) keying on the list of problem definitions presented with each case. For a better elaboration, the participants were asked to use the journalist's questions (e.g. what, why, where, when, who, which, and how). Meanwhile, the participants were directed to the POCM and Onto-RPD artefacts being asked to populate or relate their proposed problem definitions to the concepts on the artefacts, or reversely to use the artefacts' concepts for the knowledge retrieval and define new recruitment problems.

At the end of the discussion on each case study, participants were given time to assess the application of POCM and Onto-RPD artefacts to each case study, and answer a list of semi-structured questions in the templates prepared for that purpose. The participants were also asked to write down their comments and suggestions. The questions were to assess the feasibility and contributions of the artefacts in the following:

- Definition of key recruitment problem concepts embedded in a recruitment case study.
- Inclusion and integration of many recruitment stakeholders' perspectives.
- Capturing and representation of the problem situational structure in each case study and its relationships.
- Better recruitment problem understanding and analysis towards solving recruitment problem.

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5.2 Evaluation

The two phases were planned to be conducted using the same participants of the preparation phase through two focus group meetings, one for each phase. Due to the difficulty to arrange these two separate meetings and get a consensus among all participants on the time and location of the two focus group meetings, the meetings were ultimately arranged in one focus group meeting on the same day at the same location. Thus, the meeting was divided into two sessions, one session for each phase. For this arrangement, the participants were contacted via email and the maximum number of participants agreed on the proposed time and location of focus group meeting was 10. Hence, the evaluation of the POCM and Onto-RPD was carried out with a focus group consisting of 10 experts from different recruitment-related domains (e.g. HR, marketing, psychology, and management).

After the demonstration and assessment of POCM and Onto-RPD across each case study, the purpose of this session was to generally examine how well the POCM and Onto-RPD artefacts have addressed the practical problems explicated and whether they have achieved the requirements.

At the time of invitation, a package including the POCM and Onto-RPD artefact, a list of the recruitment problem cases and the problems defined by participant for each case, a list of defined terminologies, and a questionnaire with instructions of use were sent to the participants. The experts were asked upon each case study to discuss the recruitment problems, their relationships, and mapping to the resulting concepts and sub-concepts as incorporated into the POCM and Onto-RPD. A questionnaire was then completed by each expert after the discussion. In the evaluation session, participants were asked to write down their comments on the contribution of the artefacts to the requirements prescribed using the templates provided. At the end of session, they were also asked to add their suggestions and recommendation for improving the artefacts.

5.3 Key Findings from the Evaluation

The key findings from the evaluation that is centred on the requirements and characteristics of the model are presented in section 3.2, are as follows:

- Comprehensive: three experts clearly confirmed that the POCM and Onto-RPD are complete covering the required knowledge of recruitment domain. For instance, one expert stated “it is impressive, I can say that your models (i.e. POCM and Onto-RPD) are quite full”. In contrast, one expert stated that “the two models in addition to the glossary shall be used together for complete knowledge, the POCM was little vague until I referred to the Onto-RPD and glossary”.
- Generic: six experts acknowledged that the POCM and Onto-RPD are quite generic but with some comments. One stated “some specificity would be helpful especially with selection and interview processes”. Another stated “information domain could be clearer with more specific attributes e.g. job attributes”. One also argued “the goal (fill vacancy) needs to be expanded where many stakeholders’ goals may exist”. However, from an enterprise perspective, we focus on the ultimate shared goal for which all enterprise actors shall cooperate to achieve in order to increase labour market share. While also defining all difficulties and constraints that impede the achievement of this goal from problem-oriented perspective.
- Consistent: most of experts agreed that the terms used in the models were quite common and the definitions provided are relatively accurate. However, one expert stated “the term of recruitware is new, it would be better to use more common one”. However, the term has been used in the literature and the definition has been agreed on.
- Abstract / granular: three experts confirmed that the POCM is abstract and can be applied for problem definition in different level of analysis. One stated “I think this is the best part of the POCM which accounts for why the POCM has been made too generic”. Another stated “the core elements of the POCM can be instantiated in different abstraction levels”. In contrast, some argue “the POCM is good for management problems”.
- Perspicacious: five experts confirmed that the POCM and Onto-RPD were easy to understand and promoting problem analysis. One expert commented “many problem scenarios have been applied which makes clear that the POCM and Onto-RPD are very effective in this part”.

Another stated "I can understand where the conflicts might happen". Moreover, one stated "The POCM and Onto-RPD help pose questions that may have been forgotten by a stakeholder". Some argue that it lacks a step-by-step method to define the problem.

6. Conclusions

In this paper, a high-level Problem-Oriented Conceptual Model (POCM) is proposed for conceptualising and synthesizing various problem concepts of the recruitment problem space. The POCM and hence the corresponding Onto-RPD provide a means to better understanding how recruitment problem may emerge, develop, and change over time. POCM also represent and reason about possibly conflicting aspects of the recruitment interests arising from different enterprise recruitment entities. The future work will focus on developing a systematic approach to transition the recruitment problem knowledge that is embedded in the POCM to an e-recruitment requirements specification.

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