

Analysis of Intellectual Property Rights Guidelines for Crowdsourced Software Engineering Platforms

Badariah Solemon¹, Hani Al-Bloush²

¹Institute of Energy Infrastructure, Universiti Tenaga Nasional, Jalan IKRAM-UNITEN, Kajang 43000, Selangor, Malaysia, badariah@uniten.edu.my

²College of Graduate Studies, Universiti Tenaga Nasional, Jalan IKRAM-UNITEN, Kajang 43000, Selangor, Malaysia, hanibarjes@yahoo.com

ABSTRACT

Crowdsourced Software Engineering (CSE) is as a powerful tool to generate better software products or services with high quality, better reliability, and flexibility at a lower cost and shorter time. The Literature review performed shows there has been no investigation conducted on how existing crowdsourcing platforms supporting CSE activities deal with the rights of intellectual property (IP) produced by the crowd for the crowdsourcer. Therefore, we researched to develop new IP rights (IPR) guideline for such crowdsourcing platforms. Before developing the new guideline, we identified and analyzed four existing IPR guidelines. The guidelines are 1) Guideline for Treatment of Intellectual Property Rights in Information and Communication Technology (ICT) Contracts, 2) Government IP Policy and Best Practice Guideline, 3) IP Guideline for Custom Software Development Contracts, and 4) Implementation Guide Policy on Title to IP Arising Under Crown Procurement Contracts. The results of the analyses reveal two components and several sub-components essential to set straight the structure of the new IPR guideline. The two components are Introduction and Guideline. The sub-components are Background, Purpose, Scope, Definition, and Statement of Policy for the Introduction component and Description, Circumstances, Anticipates, and Benefits for the Guideline component. This new IPR guideline is vital to provide the stakeholders of CSE activities with the direction to a more logical decision-making sequence related to CSE platforms.

Key words: intellectual property rights (IPR), guideline, crowdsourced software engineering (CSE), protection, ownership

1. INTRODUCTION

The crowdsourcing approach introduced by Howe in 2006 has inspired the creation of a new landscape for software engineering activities through the exploitation of collective intelligence in an online, distributed problem-solving and production environment[1-3].

As stated in [3], “Software engineering no longer takes place in small, isolated groups of developers, but increasingly takes place in organizations and communities involving many people.” Various terms have surfaced to indicate this new landscape for software engineering activities, and among them is ‘Crowdsourced Software Engineering’ (CSE)[4]. CSE can be easily distinguishable from an in-house development based on the ways of working of the former through open call format that allows anyone to participate.

Since CSE has unique features, the software industry takes the opportunity to obtain the benefits of these features to generate better software products or services with high quality, better reliability, and flexibility at a lower cost and shorter time [3,4,6]. For instance, TopCoder’s crowdsourcing development holds the ability to provide crowdsourcer’s request at a lower cost with less time and less defect rate [7]. These promising benefits reported mainly by TopCoder are cost reductions of 30% - 80% or 5 to 8 times decrease in defect rate compared with in-house software development practices as reported in[8].

Crowdsourcing software engineering activities may introduce a potential emergence of an Intellectual Property (IP) concern since software development “is an intellectual activity and is dominated by often-neglected human factors (called human aspects in software engineering research). Among the many skills required for software development, developers must possess high analytical problem-solving skills and creativity for the software construction process.” [9].

The Cambridge Dictionary defined IP as “someone’s idea, invention, creation, etcetera, that can be protected by law from being copied by someone else.” Software engineering tasks completed through CSE platforms may have IP concern as these crowdsourcing tasks are contrary to in-house development through the normal recruitment process.

In the context of management and control of intellectual property rights (IPR), generally, the employer will own the intellectual property (IP) generated by its employees while in their employment. In the case of CSE, the ownership is

ambiguous because of the involvement of three different stakeholders (crowd, crowdsourcer, and platform).

Thus the default IPR and commitments in crowdsourcing situations are contrary to that of in-house employment. While existing literature emphasizes IP concerns in general, together with its associated risks and strategies on how to balance the rights of the crowdsourcer and the crowd, there has been no investigation conducted on how existing crowdsourcing platforms supporting CSE activities deal with IPR. Therefore, we conducted research to develop a new IPR guideline for crowdsourcing platforms for supporting CSE activities to guide crowdsourcing platforms to strike a balance between crowdsourcer protection and crowd participation maximization to increase crowdsourcing success.

Before developing the new guideline, we identified and analyzed four existing general IPR guidelines, as discussed in Section IV of this paper. Section II presents a literature review of CSE activities and IPR concern, and Section III briefly explain the methodology used to develop the new IPR guideline for crowdsourcing platforms to support CSE activities. Section V concludes the findings of the analysis.

2. MATERIALS AND METHODS

This section begins with the review of literature related to the roles of three crowdsourcing actors: crowdsourcer, platform, and the crowd. Then it moves on to the assessment of IPR concerns and IPR protections in CSE activities and methodology adopted in building the IPR guideline for crowdsourcing platforms.

A. Roles of Actors in a Crowdsourcing Process

Based on Howe’s definition, the three types of actors who play various roles in the crowdsourcing process are *crowdsourcer*, *crowd*, and *platform*.

In the case of CSE, the crowdsourcer could be an organization or individual who seeks online assistance to get software engineering tasks done, the crowd are often individuals who take part in developing software engineering tasks, and the platform provides an online infrastructure that acts as a mediator between the crowdsourcer and the crowd to accomplish the CSE tasks. Figure 1 depicts the roles of each actor need to act upon, and the interactions that exist between the actors.

Typically, crowdsourcers and crowd on these crowdsourcing platforms are unknown to each other and may not abide by similar rules and the roles of regulatory for accomplishing the tasks [10].

Therefore, crowdsourcing platforms play a vital role in facilitating the interaction between crowd and crowdsourcers. This interaction happens through a series of mechanisms

involving enrolment, authentication, crowdsourcer task broadcast, task assignment, assistance, crowd skill declaration, time negotiation, price negotiation, result submission, result verification, coordinate crowd, supervise crowd, and feedback loops.

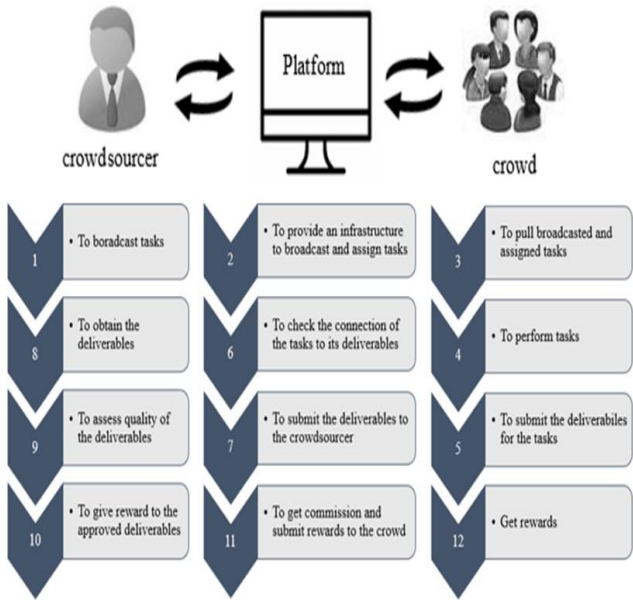


Figure 1: Crowdsourcing actors and roles

B. CSE Activities and IPR Concern

Any software activities can be crowdsourced [12], including software analysis, software design, software coding, software testing, software verification software evolution, and software maintenance. These CSE activities are implemented in the form of assigned tasks through online open call involving various CSE stakeholders, who play different roles and interact with each other to complete CSE activities. Each task may involve different stakeholders according to the specialized knowledge of the assigned task, which requires different skills, tools, and techniques to accomplish the task [4, 13]. CSE tasks include requirements related tasks such as software idea generation, capturing user requirements, requirements categorization, converting user requirements into software feature, and representing software requirements into a UML diagram. Other CSE tasks include user interface design, algorithm writing, software design, receiving design feedbacks and critiques, writing codes for the design, reviewing the codes, functional test, performance test, usability test, localization test, GUI testing, code testing, beta testing, problem mitigation, general evaluation, test generation, non-expert verification, software adaptation, software documentation, and software localization.

A range of previous studies has considered potential IPR as a source of concern on the assigned CSE tasks. Of these

studies [3, 4,14-18], stated that CSE tasks require intellectual creativity and may raise a concern about knowledge and IPR. Most of these studies did not clearly express specific IP challenges. However, Ford, Robert, Brendan, and Michael in[19] briefly stated that the concern is the IP ownership and focused on who would own the actual IP created by the crowd. De Beer et al. in [15] confirmed not only the IP ownership concern but also the existence of the associated risks of the content submitted by the crowd.

C. Types of IPR Protection in CSE Activities

The field of software engineering is considered a field requiring creativity encompassing nearly all of its aspects like requirements specifications, design documents, and source code represent [20]. Liu, Feng, Li, Jing, and Yang in [21] commented that *“While culture being the software controlling the human mind, computer software development becomes one of the most creative activities that human undertakes since the civilization began.”* In this regard, it is not surprising that software protection under IPR is critical to the software industry [22]. Moreover, Afegbua in [23] stated that: *“IP rights are at the foundation of the software industry, the term refers to a range of intangible rights of ownership in an asset such as a software program.”* IPRs are therefore considered in itself an asset, a slice of the overall ownership pie. With its relevance, there is a need to manage the protection of IPs, and this is the rationale behind the available provisions in the law providing different types in protecting ownership rights. The six types of IPRs protections that are relevant to software engineering activities are namely: copyrights, patents, trade secrets, trademarks, industrial design and database rights [24].

D. Methodology

Our research proposes a concrete guideline encompassing the integrated CSE activities detailing recommendations to the crowdsourcing platforms on the proper management and control of IPR shall provide a definite direction to improve their process in software task broadcasting and assigning mechanisms. The input to build and define the recommendations in the guideline begins with the review of literature and document analysis. Then, the research continues with the development of the guideline specific for IPR management and control.

In order to build the IPR guideline for crowdsourcing platforms, we analyzed legal documents of existing crowdsourcing platforms and reviewed existing IPR guidelines. Then, we abstracted the standard rules or instructions from these guidelines. Later, we identified the circumstances revolving around the value of the Foreground (newly created IP) to enable the creation of the decision-making process regarding the Foreground ownership and licensing options. As part of the identification of sound practices, we also reviewed available online contractual

agreements to be able to conclude which form is superior to deliver an enforceable agreement ensuring the delivery of transparency and fairness between entities. In order to ensure a logical presentation of the recommendations, we synthesize the structure and component of the guidelines.

The development of consolidated evaluation criteria follows this as the lack of specific IPR guideline was identified through two widely used appraisal criteria for practice guidelines. Then, the process continues to identify the domains essential to ensure the quality of the IPR guideline, and the items to provide a unique dimension for the domain. The proposed guideline when through two rounds of evaluation and refinement using the consolidated evaluation criteria. However, due to limited space, this paper focuses

only on presenting the results of the analysis of existing IPR guidelines that form the basis of the new guideline for crowdsourcing platforms supporting CSE activities.

3. Results and discussion

A. Overview of the Existing Guidelines

The four guidelines analyzed in this study are 1) Guideline for Treatment of Intellectual Property Rights in Information and Communication Technology (ICT) Contracts (G1)[25], 2) Government IP Policy and Best Practice Guideline (G2) [26], 3) IP Guideline for Custom Software Development Contracts (G3) [27], and 4) Implementation Guide Policy on Title to IP Arising Under Crown Procurement Contracts (G4) [28]. These guidelines set out approach (G1), framework (G3), and policy (G4) to make appropriate decisions on Foreground arising from general contract deliverables between entities. Slightly focused guideline G2 provides best practices guidelines to assist Government Agencies to make appropriate decisions on Foreground arising from contract deliverables between entities. Table I presents a summary of four guidelines and their necessary information, which streamlined the IPR practices of different organizations according to their activities, labelled from G1 to G4.

As stated in [29], guideline documents provide an appropriate and reliable source for understanding the IP sound practices required in various circumstances. The practices revolve around the decision-making process to identify IP rights ownership and licensing (i.e., commercialization, utilization, and modification). The decision-making process highly depends on the provisions regarding the complexities surrounding the identification of the first owner of a Foreground and the variety of the probable circumstances [30].

Table 1: List of existing IP guidelines and related information

ID	Name	Category	Origin	Authors or Publisher	Year	Source
G1	Guideline for Treatment of Intellectual Property Rights in Information and Communication Technology (ICT) Contracts	ICT	New Zealand	New Zealand State Services Commission	2008	[25]
G2	Government IP Policy and Best Practice Guideline	Generic	Australia	Department of Industry and Resources in conjunction with the Government IP Policy Council	2003	[26]
G3	IP Guideline for Custom Software Development Contracts	Software Development	Canada	Department of Highways and Public Works Information & Communications Technology	2005	[27]
G4	Implementation Guide Policy on Title to IP Arising Under Crown Procurement Contracts	Generic	Canada	Ministry of Industry, Government of Canada	2015	[28]

Parr in [31] substantiates the view regarding the issues in his book concerning licensing, where he emphasized the need for identification of the first owner of the Foreground to ensure proper exploitation.

The IP anticipated in the deliverables of software engineering activities includes all application software, database software, web software, documents, materials, recorded information of other assets, and products of any kind. Out of the four guidelines, only one guideline suits for software engineering activities (G3). Two are of the generic category (G2 and G4), and another one is for the general Information and Communication Technology (ICT) category (G1).

B. Foreground Ownership and Licensing Position

A review performed on these four guidelines revealed the differences with regards to their scope of applications. However, similarities observed between each other are the provision of standard rules or instructions in making appropriate decisions, whether regarding the Foreground ownership and licensing position between entities (clients and suppliers). The provision is consistent with the Oxford dictionary in defining guideline as “... *set of rules or instructions that are given by an official organization telling you how to do something, especially something difficult*”.

There are three primary positions for the IPR ownership and licensing provided by these guidelines, labelled from P1 to P3, summarized in Fig. 2. Primarily, these guidelines seek to provide clarity and direction on all the probable circumstances, in which clients must be granted ownership right on any Foreground arising from the deliverables. The direction comes to the context based on the precaution needed to be taken by the client before getting into an agreement as stated in [32], which suggested that clients are supposed to provide

the intention to own the Foreground explicitly. The precaution helps avoid the settlement with a silent agreement wherein best case scenario can only grant the license to the client. Secured IP ownership is a must before any IP execution as failure to do so may disrupt the attainment of the desired objective, and this ensures the right of the client on the developed Foreground in order to avoid any inappropriate exploitations [33].

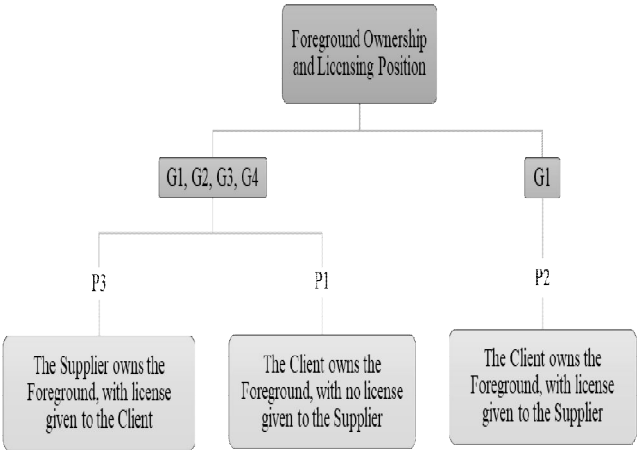


Figure 2: Summary of Foreground ownership and licensing positions

Based on Fig. 2, all of the guidelines provide an option for the client to own the Foreground without granting the license to the supplier (P1). Although G1 provided an ownership circumstance wherein even if the client is to own the Foreground, the supplier owns the license for exploitation for the satisfaction of both parties (P2). These guidelines also specified cases wherein the client might

consider not acquiring the ownership right provided that it does not affect the desired purpose (P3). Therefore, in these particular instances, the supplier has the opportunity to own the Foreground with a pre-requisite that the client holds the exploitation license, which includes any third-party affiliation. Burden in [34] commented on that as “...if a client is not going to own the IP rights but is concerned about its potential loss of competitive advantage if the supplier can market the new materials elsewhere freely, a provision can be inserted to prohibit the supplier utilizing the materials with the client's competitors (either at all or for a stated period)”.

C. IPR Ownership and Licensing Strategy

Based on the analysis of the four guidelines, there are three proposed positions on the ownership and licensing strategy after taking into account individual circumstances based on the necessity of the Foreground. These circumstances revolve in general around the value of the newly arising IP or Foreground and the pre-existing IP or Background, which is provided by both client and supplier and primarily influence the decision-making process presented in each of the Foreground ownership and licensing position offered by these guidelines. After this, the circumstances presented in each of the guidelines were categorized based on the similarities and were linked upon the rationale supporting the position an entity must undertake. For instance, G1 stated that IPR applicable to a critical system supports the position whereby the client should own the IP rights [35]. Taking another example in G2, it states that statutes, regulations, or prior obligations of the client to a third party or parties preclude supplier ownership of the Foreground [36]. This circumstance was grouped with the circumstance presented in G1 as both support the same position. The categorization, in turn, simplifies the decision-making process by summarizing which circumstances support each of the positions supported by a valid rationale. In summary, 13 circumstances are supporting this three ownership and licensing positions, as presented in [11].

As the nature of circumstances enables the identification of the appropriate position to be undertaken, this finalized position will limit the scope of necessary provisions required in the contractual agreement. The position is a legally enforceable agreement binding the two entities whereby the acceptance signifies absolute compliance and any non-compliance. In alignment with the goal of this study, the electronic version of contractual agreement where users can access and signify to the provisions of the legal agreement online is analyzed further. Legal agreements are in the form of a contract in which involved parties to act in full compliance with the contract. The formation of online contractual agreements prominently used in the online marketplace (i.e., website) is *clickwrap* and *browsewrap*. Fig. 3 shows an example of a *clickwrap* where the user gets to read the terms and conditions of use of a website (on a page, or in a scroll box), and clicking on a button ‘I accept’ or any other language with similar meanings shall signify undertaking the

desired activity. On the other hand, a *browsewrap* enables websites to present terms and conditions, which is commonly through accessing a hyperlink not requiring any active expression of consent before undertaking any activities. As reported in [37], *browsewrap* agreement will be typically placed and linked at the bottom of the website. Thus, clicking the ‘Terms of Service’ link shall present the legal agreement terms, as seen in Fig. 4.

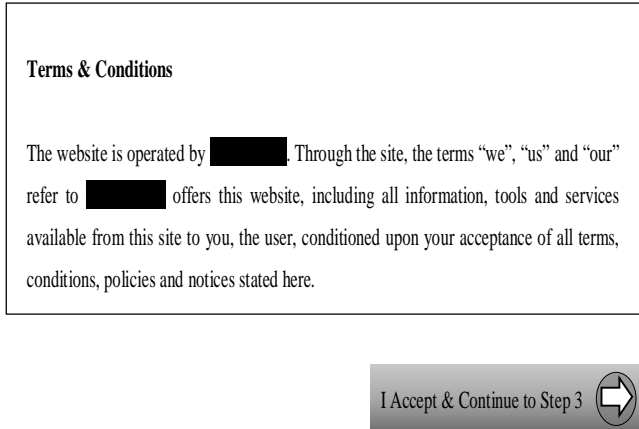


Figure 3: Sample of *clickwrap* online agreement

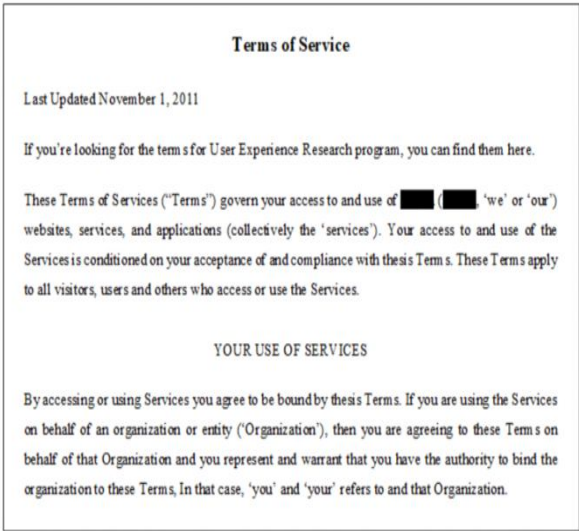


Figure 4: Sample of *browsewrap* online agreement

Although the approach protects users using *clickwrap* and *browsewrap* agreements, it does not dilute the existence of some legal issues. Because of *browsewrap* nature of not drawing attention to the actual agreements and terms, the crowdsourcing platforms may resort in hiding the provisions of the terms and, /or deflecting attention from the terms (i.e., use of graphics and small font sizes and use of complex searches through screens to find the terms) [38].

According to Marotta-Wurgler, in [39], responsible users “...are likely to read and digest terms in a medium conducive to speed, instant gratification, and manipulation.”

However, it is a typical case that the users exhibit reluctance to read the terms and appeal to unfair terms even if these are properly presented. Somehow, the user cannot argue that a contract does not exist just because the user did not read it before proceeding. Therefore, even if *clickwrap* is similar to the traditional paper transactions, which requires solicitation of consent, it is at times an overstatement if the user did not recognize their responsibility of reading and understanding the terms [40-41].

D. Structure and Components of the Guidelines

Table 4 presents a summary of the review of the guidelines selected in this study based on their structure and components. The structure of each guideline presents the design of the documents concerning its function and has two domains, which firstly introduces the source of the IP and consequently presenting the IP sound practices in guiding the decision-making process. The review findings show that the structure of the guideline is generally similar among the guidelines. The finding is consistent with [39] in their recommendation that "... a guideline can be structured either as collections of decisions that are to be applied in specific situations or as processes that specify activities that take place over time". Peleg et al. in [42] affirmed that the overall flow of the guideline structure starts from the integrated description of the decision-making process and activity specification and ends with a description of the process of expression that allows for sequencing and repetition in decisions and activities.

Table II shows the two main components of the guidelines, *Introduction* to provides the general components of the guideline, and *Guidelines* to present sound IP practices. The *Background* component of G1, G2 and G3 provides the context of the creation of the documents. Despite G4 not having a separate component to present the Background of the guideline, it was briefly explained in another component which is *Purpose*. Each of the guideline presents the rationale on the creation of the guideline under three

headings. The headings are: 1) *Purpose* to provide the areas where the guideline is applicable to under, 2) *Scope* to give clarity, and 3) *Definitions* to align the interpretation of terms that are being used throughout the guideline. On the other hand, G1, G2, and G3 have a component named *Statement of Policy*. This component provides the underlying philosophy of the guideline to be related to the agencies' and or parties' mission and values, a component tailored to the entities involved in the guidelines.

With regards to the review of the components of the specific IP practices, the guidelines were presented in a rational approach by initially introducing the description of the IP ownership position alongside with the enumeration of its applicable circumstances followed by the benefits for the use of the aforementioned option. As compared to the other guidelines in which clearly defined the pre-condition or *Anticipates* of the position, G2 included the allocation processes in determining the ownership. Besides, G2 presented sound practices only by enumeration in contrast with G1, G3, and G4, whereby sound practices were summarized using a pre-determined decision flow process. Based on the review of the components, the essential guideline's components are *Introduction* and *Guideline*. The *Introduction* component consists of *Background* to presents the context in the creation of the guideline, *Purpose* on what the guideline is for, *Scope* to present the extent to which the guideline is relevant, *Definitions* to provide definite meaning into the terms used in the guideline, and *Statement of Policy* in order to achieve the purpose of the guideline. As for the *Guideline* component, the following sub-components are proposed: 1) *Description* to clearly describe the IPR ownership positions including the scope of the management of the IP, 2) *Circumstances* to present the situations where the IP ownership position is applicable and not applicable, 3) *Anticipates* of the IP ownership position to describe the pre-condition of the IP either be Foreground or Background, and 4) *Benefits* to provide a line of sight in between the position and the objectives of the parties involved.

Table 2 : Structure and Components of Existing IP guidelines

		G1	G2	G3	G4
Structure of the guidelines		Foreground in ICT Contract Deliverables → Sound Practices Guidelines	Foreground in Government Contract (GC) Deliverables → Sound Practices Guidelines	Foreground in Customer Software Development (CSD) Contracts Deliverables → Sound Practices Guidelines	Foreground arising in Crown Procurement Contracts (CPC) Deliverables → Sound Practices Guidelines
Specific practices		• Right to Foreground in ICT contract Deliverables:	• Right to Foreground in GC Deliverables:	• Right to Foreground in CSD contract Deliverables:	• Right to Foreground in CPC Deliverables:

		Ownership and Commercialization	Ownership and Commercialization	Granting and Retention of Foreground Ownership	Ownership and Exploitation
Sound practices guidelines for implementation		<ul style="list-style-type: none"> Set out an approach to make appropriate decisions on Foreground arising from contract deliverables between entities 	<ul style="list-style-type: none"> Best practices guidelines to assist Government Agencies to make appropriate decisions on Foreground arising from contract deliverables between entities 	<ul style="list-style-type: none"> Provides a framework to make appropriate decisions on Foreground arising from contract deliverables between entities 	<ul style="list-style-type: none"> Set out a policy to make appropriate decisions on Foreground arising from contract deliverables between entities
Component of the guidelines	Introduction	<ul style="list-style-type: none"> Definitions Purpose Scope Background Statement of Policy 	<ul style="list-style-type: none"> Background Purpose Scope Definitions Statement of Policy 	<ul style="list-style-type: none"> Background Statement of Policy Definitions Purpose Scope 	<ul style="list-style-type: none"> Purpose Definitions Scope
	Guideline	<ul style="list-style-type: none"> Description Circumstances Anticipates Benefits Practical Examples 	<ul style="list-style-type: none"> Description Default option Exceptions Circumstances Anticipates Benefits 	<ul style="list-style-type: none"> Principles Exceptions Circumstances Anticipates Benefits 	<ul style="list-style-type: none"> Description Steps Circumstances Anticipates

4. CONCLUSION

This paper establishes the importance of IP rights management by providing a comprehensive review of the sound practices in four existing guidelines. The review reveals three primary positions for the IP rights ownership and licensing provided by these guidelines and the identification of the thirteen circumstances supporting these three positions, which evolve in general around the value of the newly arising IP or Foreground and the pre-existing IP or Background. Additionally, this finalized position shall enable the identification of necessary provisions required in a contractual agreement in which in an online marketplace takes form as *clickwrap* and *browsewrap*. In this paper, the analysis of four existing IPR guidelines named as G1, G2, G3, and G4 resulted in the identification of components and sub-components for the proposed new IPR guideline for crowdsourcing platforms to support CSE activities. This

paper begins with the literature review of CSE activities and IPR concerns in Section II, followed by brief explanation of the methodology adopted to develop the new IPR guideline. The identification of those components is essential to set straight the structure of the new IPR guideline so that it can provide end-user with the direction to a more logical decision-making sequence.

The four guidelines have been evaluated based on consolidated criteria. The criteria were developed for the appraisal of the quality of guidelines specifically for the management of IPR. The criteria include *scope & purpose, stakeholder involvement, the rigour of development, clarity of presentation, update date, and applicability*. The evaluation was conducted not for the purpose of verifying the validity of these guidelines as these guidelines are valid and are currently active. Instead, it is a confirmatory exercise for the presence and absence of the criteria and how these

influence the fulfilment of the guideline's purpose. The evaluation results of the four guidelines and the detailed explanation of the new guideline for CSE platforms are detailed in [11].

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