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# Defining Skill Sets Requirements for Agile Scrum Team Formation

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**Abstract:** Agile Scrum Software development methodology has been accepted widely by the Software Engineering (SE) community. This is mainly due to agile principles that emphasize on rapid development process which enables working quality software to be delivered on time. Successful Agile Scrum project depends on the high-performance of team members that assigned to a specific software project. Therefore, Scrum project highly demand the right person to be assigned as a team member. Due to this, skill sets requirements among team members are significant for the project manager to select the best team. There are two types of skills for team members that need to be identified-hard skills and soft skills. Thus, this study aims to define each of the skills set requirements based on review of literature and expert's opinions. It is hoped that the defined skills set requirements can serve as a guideline to develop a comprehensive Agile team formation method.

**Key words:** Agile, Scrum, team formation, soft skills, hard skills, comprehensive

## INTRODUCTION

Identifying individuals that would comprise a high-performing team is highly challenging for decision makers. This is specifically true for Agile teams because team dynamism plays a critical role during the IT Software development project (Howard and Rogers, 2011). Extant research in this field has demonstrated that several factors can influence team formation. Thus, in order to ensure that the IT Software development project can be delivered on time and within the allocated budget, it is essential to take them into account when selecting team members. Among of these factors are groupthink, personality, value diversity, role identity, stability and team size (Hoegl and Gemuenden, 2001; Manzi and Sharifah-Lailee, 2010; Tsirakidis *et al*., 2009; Weimar *et al*., 2013).

The Agile principles indicate that determining the most optimal team structure for an Agile IT Software development project is a complex task and needs a systematic approach to realize it. If chosen correctly, Agile team members will be naturally committed to the team and the project until its completion. Team member selection and allocation on software projects is generally left to the judgement of the management team without systematic tools to help with the process (Zaraket *et al*., 2011). This has led to imbalance of members in software development project team.

Currently, most project managers and team leaders select team members with highly technically skilled (Donsbach *et al*., 2009; Moe *et al*., 2008). Nevertheless, due to dynamic software development environment, management must take into consideration the factors of team dynamics, personalities and domain knowledge in forming Agile Scrum product team to ensure the team is well-equip with the right attitudes, knowledge, skills and independence to complete assigned project (Schwaber, 2004).

Agile Scrum team functions and delivers result differently from normal team, thus, there is increasing demand for the team members to be equipped with soft skills and hard skills (Culler, 2012). Soft skills is required to ensure the smoothness and acceleration of communication process while hard skills is required to ensure deliverable of quality product to the stakeholders (Capretz and Ahmed, 2010). Software developers require to fully equipping with soft skills and hard skills to improve team performance. However, a comprehensive review on the detail of skills sets required for an Agile

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Scrum team is limited. Thus, this study will highlight the significant skillsets criteria to assemble and form right Agile team members.

## MATERIALS AND METHODS

**Agile Scrum team formation:** The Agile Scrum team is a self-organizing and cross-function team that does not comprise of traditional software engineering tasks role such as designer, programmer, architect or tester in delivering a complete IT Software, application or project (Cohn, 2010). In contrast, every member in the project performs as a team to complete the work that has been promised within each sprint. The roles in an Agile Scrum team are the Scrum master, product owner and the development team.

A typical Agile Scrum product team is made of with five to nine developers in a team. Every member in team is needed to play active role in each IT Software stage, starting from idea formation, software design, software testing, implementation and maintenance support phase (Schwaber, 2004). In other word, teamwork plays a vital role to the success of the Scrum project. However, there is a challenge with forming high performing Agile Scrum product team is that it requires a high level of both individual and team autonomy (Moe *et al*., 2008). Thus, a dynamic team member is highly needed to form an effective Agile Scrum product team. In an Agile Scrum environment, the whole team inclusive of all aforementioned roles needs to participate actively in completing a project. No one role can accomplish completion of a project without the support from the other roles. In an Agile Scrum product team, each role complements each other in reaching toward the team goal (Cohn, 2010). Selection of projects and the allocation of team members to work on the selected project based on the individual's technical skills have been proven to maximize profit for software companies (Zaraket *et al*., 2011).

In addition, the effectiveness and high performance of one team is also directly supported by soft skills like communication skills, management skills, thinking skills, teamwork skills, leadership skills, creative skills, facilitation skills, analytical skills, people skills, interpersonal skills and planning skills (Capretz, 2010; Cohn, 2010; Gupta and Suma, 2013; Licorish and Donell, 2014; Project Management Institute, 2013).

Hence, this study will define team member's soft skills and team member's hard skills required for Agile Software team members through review of literature and interviews from the software experts.

**Skill sets requirements:** In this study, experts from the software industry which arean Agile project manager and a certified Agile Scrum master were chosen as the interviewee to get in-depth understanding on the significant criteria of team member's skill sets that have more impact towards delivering high quality working software. In addition, based on literature and interview findings the skillset requirements can be defined as follows:

Table 1: Hard skills requirement

| Hard skills | Supporting literature review |
|---|---|
| Programming language | Zaraket *et al*. (2011), Culler (2012), Cohn (2010), Gupta and Suma (2013) |
| Spoken and written language | (Culler (2012) |
| Database | Zaraket *et al*. (2011), Culler (2012), Cohn (2010) |
| Expert area | Culler (2012), Cohn (2010), Gupta and Suma (2013) |
| Scrum role | Donsbach *et al*. 2009, Culler (2012), Cohn (2010) |
| experience | Hidding and Nicholas (2014) |
| Scrum hours | Culler (2012), Cohn (2010), Gupta and Suma (2013), Culler (2012),Uikey and Suman (2012) |
| Number of sprint | (Culler (2012), Cohn (2010), Gupta and Suma (2013), Culler (2012),Uikey and Suman (2012) |
| Scrum knowledge | (Culler (2012), Cohn (2010), Gupta and Suma (2013), Uikey and Suman (2012) |

**Hard skill sets requirements:** Hard skills are particular, teachable faculties that are required to complete one job or role in work place. The skills are easy to measure (Capretz and Ahmed, 2010). Examples of hard skills include typing, knowledge of computer programmes like Microsoft Office, operating machinery and speaking foreign language. Table 1 listed down hard skills requiredby an Agile Scrum product team member, acquired from the literature review.

One of the significant skills required for Agile Scrum team members is programming language skill. Programming language is a formal constructed language designed to communicate with computers; instructions that can be translated into machine language and then executed. It is used to create programs controlling the behaviour of a machine. There are many programming languages and new ones are being continuously developed. Examples of programming languages are C, C#, C++, Java, PROLOG and many others. High proficiency in programming language is essential for software engineers because it allows for faster and easier construction of complex instructions.

Other than programming skill, communication skill either spoken or written is also important. Spoken language is oral language or vocal language used for immediate communicate with other human beings while written language is the representation of the spoken language in a writing system. Examples of popular written and spoken languages are English, Bahasa Malaysia, Mandarin, Tamil, Spanish and many more. Written language must be taught whilst spoken language is learnt by exposure without being specifically taught. Higher

command of spoken and written language enables team member to converse with wider range of people especially for those bilinguals. Team members with high spoken and written language proficiency are more valuable in the global job market or global projects. It is expected that team members that have diverse languages can give benefit to the team.

In order to ensure that the software delivered meet the customer needs; database of the system must be reliable. Thus, team members must require good database knowledge in developing a system. Database is a repository where collection of information are stored and organized in a manner where it can be easily accessed, managed and updated. Typically, a database provides users with the capabilities of controlling read/write access, specifying report generation and analysing usage. Examples of database are Microsoft's SQL Server, Oracle, Sybase and IBM's DB2. Proficiency in database is required in the SE field for easier and faster write, read and update of information.

Expert area or domain expert is a knowledge or authority in a particular area or topic. The term is frequently used in SE field to describe professionals with expertise in the field of application. High proficiency in expert area is important as the specialised knowledge helps individuals to review and improve technical work and also to guide and teach others. Examples of expert area or domain include artificial intelligence, business software and business knowledge, platforms like SharePoint and Joomla and control simulation.

Experience is required for any software engineer to help in completing IT Software development project. For Agile Scrum team members, Scrum role experience, Scrum hours and the number of sprint undergone by the team member are required to form effective team. Experience is required to verify if the team member has the relevant experience to contribute to the IT Software development project. Scrum role experience is used to verify if the team member has prior experience in performing any scrum roles of either as Scrum master, product owner or as developer. Scrum hours experience and number of sprint are applied to verify if the team member has sufficient experience to work on the project within the allotted time period.

Scrum knowledge is used to measure the proficiency of the team member in Scrum and Agile methodology. The knowledge includes Scrum theory, practice, process, procedure, team roles, artifacts and any Scrum related knowledge. Proficiency in Scrum knowledge is required for smoother Scrum practice in delivering working IT Software development project on time.

Table 2: Soft skills requirement

| Soft skills | Supporting literature review |
|---|---|
| Analytical skills | Capretz and Ahmed (2010), Cohn (2010), Licorish and Donell (2014), Project Management Institute (2013) |
| Communication | Capretz and Ahmad (2010), Licorish and Donell skills (2014), Hidding and Nicholas (2014), Uikey and Suman (2012) |
| Facilitation skills | Capretz and Ahmed (2010), Cohn (2010) |
| Interpersonal skills | Capretz and Ahmed (2010), Cohn (2010) Uikey and Suman (2012) |
| Leadership skills | Licorish and Donell (2014), Hidding and Nicholas (2014), Uikey and Suman (2012) |
| Management skills | Capretz and Ahmed (2010), Cohn (2010), Licorish and Donell (2014), Uikey and Suman (2012) |
| People skills | Cohn (2010), Licorish and Donell (2014), Hidding and Nicholas (2014), Uikey and Suman (2012) |
| Planning skills | Licorish and Donell (2014), Uikey and Suman (2012), Shore and Warden (2007) |
| Teamwork skills | Capretz and Ahmed (2010), Cohn (2010), Licorish and Donell (2014), Uikey and Suman (2012), Shore and Warden (2008) |
| Thinking skills | Cohn (2010), Licorish and Donell (2014), Hidding and Nicholas (2014), Shore and Warden (2008) |

**Soft skill sets requirements:** Soft skills are valuable assets when developing a project team. For example, team members can apply emotional intelligence to reduce tension and increase cooperation by identifying, assessing and controlling sentiments of other team members, anticipate actions, acknowledge concerns and follow up on issues. Table 2 listed down soft skills required by an Agile Scrum product team member, acquired from the literature review.

Software team members must have good analytical skills. Analytical skills are the abilities to visualise, articulate, solve both complex and uncomplicated problems and concept and make decisions that are sensible based on available information. This skill is important as it helps the team member to identify problems, understand implications of both current and future problem-solving actions and reviewing related information to develop and evaluate options and implement solutions. Logic is also required to analyse information and to address work-related issues and problem while creative and alternative thinking are used to develop new ideas to answer identified work-related problems.

Communication skills are the abilities to convey information to people clearly, simply, effectively and understood by the audience. It is about transmitting and receiving messages clearly and being able to read the audience. Team member also need to learn to transmit messages in persuasive manner to change or convince others to their ideas. Giving full attention to others, taking time to understand points being made by others, asking appropriate questions and not interrupt others at inappropriate times are required in receiving messages.

Besides, having a good communication skills, team members must have facilitation skills that are able to guide group members to share ideas, opinions, experiences and expertise in order to achieve common goal and agreeable action plan. The skill is required for good planning, keep members involved and create real leadership opportunities in a team. The more team member knows about how to shape and run process, the more empowered the team member feels about their own idea and participation, stay invested in the team, takes responsibility and ownership. In short, facilitation skills are in understanding the goals of the IT Software development project, keeping the team on the goal and to move forward to achieve the goal, involve everyone in meeting including the followers and the dominants and making sure decision are made democratically.

Interpersonal skills are defined as the abilities to practice life skills for everyday communication and interaction with other people (individually and in groups) in both professional and personal lives. Interpersonal skills are required to maintain good relationship with other team members. The skills include areas of verbal communication-how and choice of words used to communicate with others, non-verbal communication-facial expression, body language and hand gestures, listening skills-attentive and process information correctly, negotiation-discuss and reach to an agreement in professional manner, problem-solving-find solution to problems, decision making-making the right decision and assertiveness-confident without being aggressive.

Leadership skills are the abilities to influence others, lead and take charge when required, offer opinions and direction, aid and support others to accomplish objective and goals. Leadership skill builds a drive and a passion for team member to be daring and risk taking to translate vision and ideas into reality. Effective leadership leads other team members to work together in confident toward the set goal, encourages the feel of trust between team members and essential in achieving level of loyalty and dedication within the team.

Management skills are the abilities to make business decision and lead subordinates in planning, organising, directing and controlling within a team to achieve goal. Management skill also includes motivating, developing and directing others and identifying strength of others in contributing to the IT Software development project. Team member must try to train themselves to listen to others, be visible to other team members, model high moral standards, inspire respect and loyalt and work hard in completing the IT Software development project. Management skills are vital to build a solid foundation for success.

People skills are the abilities to use both psychological skills and social skills to communicate effectively with other team members in a friendly way; being aware of other's reactions and understanding why they react the way they do also help team member to be more tolerate to others. Higher people skills embedded in team member portray higher positive image to others which indirectly encourage positive feedback from others. In an Agile Scrum product team where team members are working closely together, the ability to get along with other team members is essential.

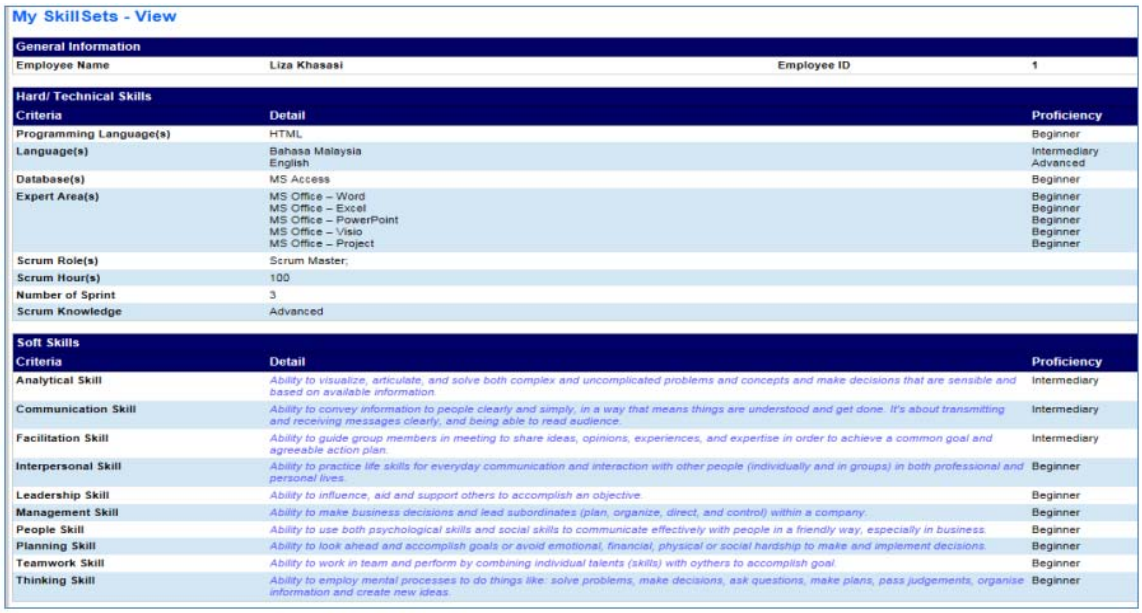
Planning skills are the abilities to look ahead, adjust actions in relation to other's action and accomplish goals or avoid emotional, financial, physical or social hardship to make and implement decisions. Planning skills are important to plan for efficient use of resources, establish goals to be met in each sprint, manage risk and uncertainty, team building and to create competitive advantages in reaching towards realistic goals of the IT Software development project.

Teamwork skills are the abilities to work in team and perform by combining individual skills with other team members to accomplish goal. Teamwork requires being pleasant with other team members, displaying a good-natured and cooperative attitude, being sensitive to other team member's needs and feelings and being understanding and helpful while working together in accomplishing the goal set by the IT Software development project. Higher teamwork among team members encourage better-managed delegation, higher team efficiency, better ideas contribution and higher support mechanism in the Agile Scrum product team.

Thinking skills are the abilities to employ mental processesto do things in problem-solving, decision-making, ask questions, make plans, pass judgement, organize information and create new ideas. Thinking skills help team member in using logic and reasoning to identify the strengths and weaknesses of available solutions, conclusions or approaches to solve problem. Thinking skills also provide team member with an approach to be open to change, to learn and apply new knowledge and to be able to process and justify own point of view from learnt knowledge.

## RESULTS AND DISCUSSION

After defining, the hard and soft skills requirements, an interface were designed to translate the skills sets requirements. Agile project managers of each team members are required to fill in member's hard skills and soft skills proficiency level information as shown in Fig 1. These hard skills and soft skills proficiency are based on the manager's evaluation based on their own judgment



My SkillSets - View

General Information

| Employee Name | Liza Khasasi | Employee ID | 1 |
|---|---|---|---|

Hard/ Technical Skills

| Criteria | Detail | Proficiency |
|---|---|---|
| Programming Language(s) | HTML | Beginner |
| Language(s) | Bahasa Malaysia<br>English | Intermediary<br>Advanced |
| Database(s) | MS Access | Beginner |
| Expert Area(s) | MS Office – Word<br>MS Office – Excel<br>MS Office – PowerPoint<br>MS Office – Visio<br>MS Office – Project | Beginner<br>Beginner<br>Beginner<br>Beginner<br>Beginner |
| Scrum Role(s) | Scrum Master; | |
| Scrum Hour(s) | 100 | |
| Number of Sprint | 3 | |
| Scrum Knowledge | Advanced | |

Soft Skills

| Criteria | Detail | Proficiency |
|---|---|---|
| Analytical Skill | *Ability to visualize, articulate, and solve both complex and uncomplicated problems and concepts and make decisions that are sensible and based on available information.* | Intermediary |
| Communication Skill | *Ability to convey information to people clearly and simply, in a way that means things are understood and get done. It's about transmitting and receiving messages clearly, and being able to read audience.* | Intermediary |
| Facilitation Skill | *Ability to guide group members in meeting to share ideas, opinions, experiences, and expertise in order to achieve a common goal and agreeable action plan.* | Intermediary |
| Interpersonal Skill | *Ability to practice life skills for everyday communication and interaction with other people (individually and in groups) in both professional and personal lives.* | Beginner |
| Leadership Skill | *Ability to influence, aid and support others to accomplish an objective.* | Beginner |
| Management Skill | *Ability to make business decisions and lead subordinates (plan, organize, direct, and control) within a company.* | Beginner |
| People Skill | *Ability to use both psychological skills and social skills to communicate effectively with people in a friendly way, especially in business.* | Beginner |
| Planning Skill | *Ability to look ahead and accomplish goals or avoid emotional, financial, physical or social hardship to make and implement decisions.* | Beginner |
| Teamwork Skill | *Ability to work in team and perform by combining individual talents (skills) with oythers to accomplish goal.* | Beginner |
| Thinking Skill | *Ability to employ mental processes to do things like: solve problems, make decisions, ask questions, make plans, pass judgements, organise information and create new ideas.* | Beginner |

Fig. 1: Sample page of hard and soft skills requirements

Table 3: Skillsets proficiency weighting

| Weightings | Proficiency level |
|---|---|
| 1 | Beginner |
| 2 | Intermediary |
| 3 | Advanced |

and assumption. Each selected skillsets of hard skills and soft skills were assigned a three-scale rating of beginner, intermediary and advanced. Rating beginner is assigned with weighting 1, intermediary as weighting 2 while advanced with weighting 3. The three-scale rating and weighting were recommended by the researcher for easier calculation. The average of all the skillset are then calculated to get the candidate's total weighting as illustrated in Table 3.

The combination data from both hard skills and soft skills proficiency levels are then calculated as average to get the total individual weighting. All these collected information are saved into an individual/candidate database to be retrieved and consumed whenever required to form a new team.

## CONCLUSION

Parameters resulting from the literature review activity and interview from the experts were used and consumed by the skillsets requirements model for Agile Scrum team formation. Hard skills criterion selected are programming language, spoken and written language, database, expert area, Scrum role experience, Scrum hours, number of sprint and Scrum knowledge while soft skills criterion selected are analytical skills, communication skills, facilitation skills, interpersonal skills, leadership skills, management skills, people skills, planning skills, teamwork skills and thinking skills. The requirements defined were only a sub process to develop a more comprehensive Agile Scrum team formation.

## RECOMMENDATION

Further research will integrate these skillsets requirements with Agile project requirements and then is able to predict the team performance.

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