Improving Scrum Model Using Inclusion Information Security Practices through Information Security Master and Backlog Framework

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Abstract— Nowadays, all organizations are faced difficulties for development of secure software. Agile method considered best approach to develop software within given time constraints. There is always a research gap related to software failure and software security concerns. Therefore, from review the existing study, we found a security gap in scrum framework and extend the scrum model by inclusions information security practices that can improve scrum model to resolve security issues. In this paper, we make a new addition of information security practices by adding the Information Security (IS) backlog and IS master in existing scrum framework in order to capture security requirement more smoothly. For checking validity via conducting empirical study from professional to get their expert opinions about security practice of scrum model. These results show that there was need of information security owner role that have a sound knowledge and expertise in order to facilitate in better way. At the end, critical discussion plays our role.

Keywords—Scrum; agile development; information security, backlog; master; software development.

I. INTRODUCTION

Software security is very important factor in any organizational or business application. Trillions of dollars rubbished every single year due to malfunctioning of Software. Various software quality matrices used to improve the security of software. Different techniques used to enhance the quality of software by modifications and improvements in security technique processes like discussed in [1-3]. Agile method is a type of SDLC incremental model by using agile software is developed rapidly by resulting every single build is developed on previous module of software. Each released properly tested and ensure reliability of each version. Different agile modeling techniques are used to develop the quality of deliverable product from [2, 4]. Different model of agile use to

ensure the adaptability and customer satisfaction related to software. In scrum model [5] refers to a group of development processes. These methods having basic features but do have certain differences among themselves. Developments of software works with the umbrella of famous Agile Manifesto 2001 [1, 6] and become popular now a days. A few Agile base models are mentioned below that are working with agile methodology: Crystal Family Method, Feature-driven, Extreme programming and scrum [3, 5]. In this research, we will try to improve the agile base scrum methodology. Scrum is considering to be best model among software development them and widely use in software development industry. The scrum contains of specific scrum roles, artifacts and meetings of scrum. Security problems typically Information security are not consisting in the scrum model. To solve this issue and avoid threats information security can apply information security to be integrate in scrum model.

There is gap between scrum and information security practices. In software development industry scrum is most popular software development methodology for a development of small to medium size software projects. In scrum model the development team more focus toward code less emphasis on information security practices. So, the integration of information security practices of software may enhance the security aspect of software projects that developed under the scrum practices. Further, integration also enhanced the capability of development team and develop large project more secure [7].

Scrum is very famous methodology for software development in software industry. From literature review [1, 5, 8 10] and detail study of scrum model technique [13], we found there are some limitations in scrum model related to security of software. Scrum is not fully trusted for software security because it does not fully emphasis on security related issues [9]. Scrum model has not much prominent security even especially with small products. In our research we have shown that scrum is not fulfilling the all aspect of security of large

projects. It is very important to enhance to capability of scrum model to cover the scope of software security. Software that builds under the scrum model and have fully coped with information security that software is completely reliable for the security point of view. In figure 1 takes from [4] new ways of working are described by using scrum technology, on top of the agile methodology with its six other sub-sections. Rest of the paper organized as: in section II, we discuss the existing state of the artwork with information-based security of scrum

model and its practices in industry. Section III illustrate the phases of scrum methodology that start from scrum phases and end its information security mode. In section IV, proposed approach is discussed long with its all possible phases. The pictorial survey -based results are listed in section V, while effectiveness of information security mater is deal with section VI, finally; conclusion is discussed in section VII.
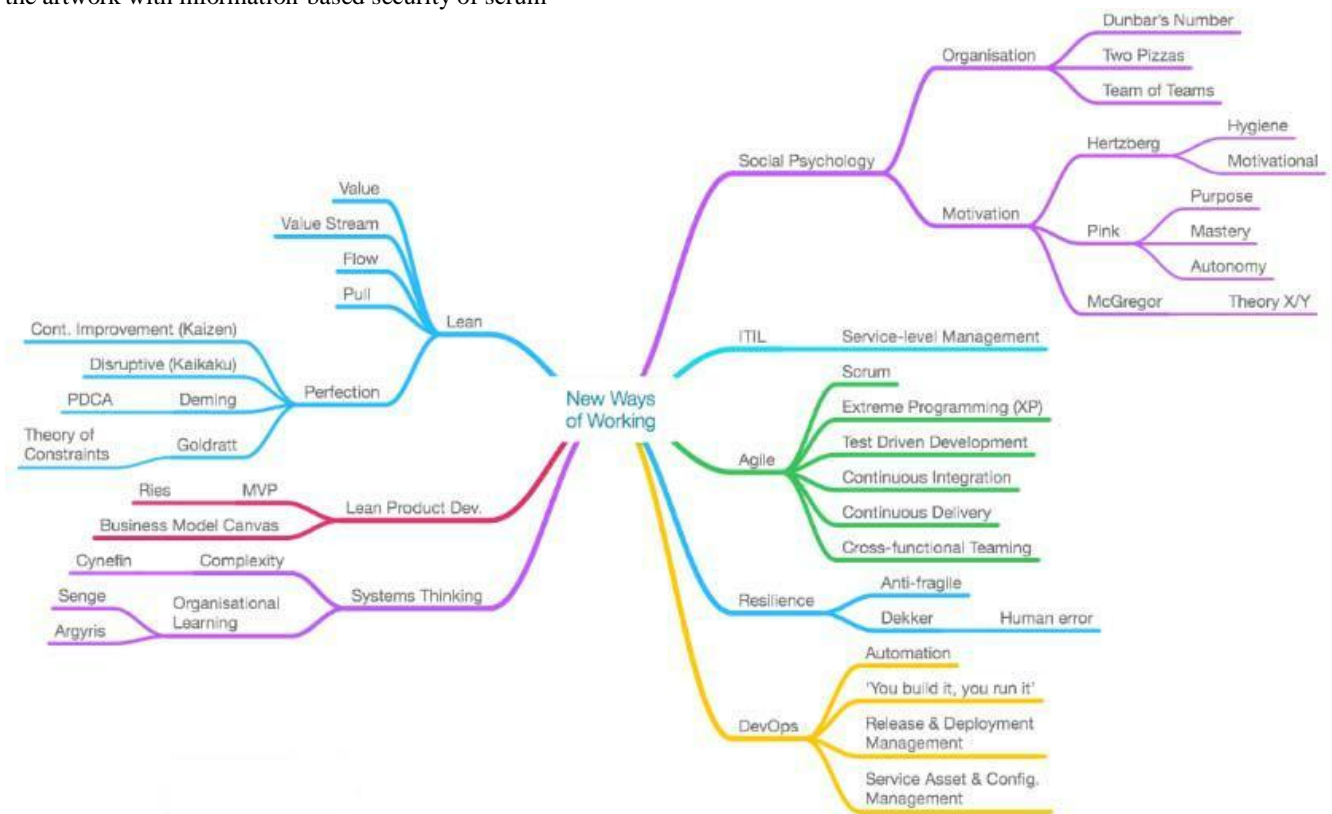
Figure 1: Contrasting the different models of SE with Waterfall, Agile and DevOps: A new ways of working strategy

II.   RELATED WORK

in this section we discuss existing state of the artwork on agile and its flavors like scrum methods. For examples the authors Moyon, F., Beckers, K., in [2, 11] discuss that agile methodology has now become popular in developing environment now a days. While using agile we must face security and other critical emerging issues. To resolve both issues is a challenge for agile developers because agile complies on linear software development. This study develops an agile based methodology model to achieve secure and continuous development by embedding these requirements into agile model. Moreover, it allows confirmation of compliance that faces active process changes environments. Eckert, C., & Waidner, M [1, 12] Cyber security is the basic need of digitization of all domains e.g. in industry, smart

supply of energy, mobility and logistics, health sectors, administration sector, and online cloud base services. Purpose of cyber security is to protect the organization's value and data to damage and even limited impact on data to loss. Cyber security analyses the IT-base system to maintain the integrity of the hardware and software. It provides guarantee to remain confidential private information and protect the sensitive sphere. Furthermore, it provides the guarantee of confidentiality, integrity, and availability and other safety prospective that provide protection in legacy with its security system. But it is difficult to achieve the secure digitization and network security in real world. This research provides current trends and improvement in the field of application-base-cyber security and outlines the current issues of cyber security problems and their potential solutions. Moneta, F. M. [3, 14-16] Software development organization globally adopts agile

methodology for software development process. With the passage of time to secure the software process is become a challenge in software industry. Where agile methodology is growing due to easy and friendly environments side by side security of software is emerging issue of agile development. It is difficult to integrate with already exist security framework of waterfall model. This research study provides the solution agile security. In this research study review 39 papers of journals published in 2011-2019. This study analyzed 39 papers published between 2011 and 2018 [17] and [21]. On the base of our study concluded we purposed developer gain more from trainings. And develop dedicated security team for secure software development. Waterfall security solution not effective for agile should adopt artifacts of e.g. "security backlog" and "user story" in agile. Daneva, M., & Wang, C. [4, 18] so much software companies are trying to investigate the integration of agile project security requirement engineering and delivery models. But very few is published that how this can be archived in practical life. This paper reports on the results of a documentary study that began to understand ready-made security practices used by organizations. They selected seven well-documented re-security frameworks for agile projects that were used in practice and conducted objective analysis based on documentation describing the frameworks and their supposed use in detail. Finally, if companies take security requirements seriously, you should consider ignoring the role of keeping the gate for the graceful product owner.

Essebaa, I., & Chantit, S. [5, 11] model engineering (MDE) and agile methods (AM) are two key areas in the process of development to facilitate the realization of it projects. However, these areas evolve separately despite the large number of researches focused on improving project implementation techniques. Kasauli, Rashidah [6, 17] Driven by the urge to be more flexible, quicker and still have high quality, large-scale companies managing safety-critical systems are transitioning to agile development methodologies in their day-to-day software and systems development practices.

Villamizar, H., Kalinowski, M., Viana, M., & Fernández, D. M. [7] Many software development companies quickly changing their business environments traditional engineering to agile development method. In a non-functional security is major requirement that still having a challenging activity for agile methodology in development environments. Find the previous research publication that deal with requirement of security engineering using agile. Systematic mapping conducting and point out the gaps in existing research work. To search find out the previous paper on agile security found 21 paper that met our criteria from 2005-17 [1, 16-26], we identify that some methods include changing agile approaches, defining new artifacts as well like increase user story or presenting new guidelines to deal with security problems. Existing approaches need to be improved and evaluating by investing more efforts on agile approaches. It is a dimension for more work in future finding mitigating and more limitation.

Morrison, P., Smith, B. H., & Williams, L. [8, 20] To prevent software from vulnerabilities applying different security practice on software. But it is not easy to find the vulnerabilities. Different security practice applies to find vulnerabilities taken much efforts and time also. If stockholder having such data, he can guide to software engineer about vulnerabilities which he/she observed while use of software. In this paper tell developer and software engineer use security practice on the base of evidence which provided. Discuss the security practice that is used in IBM software development environment. Data is collected on base of three main things. Survey conduct by developmental team (ii) qualitative observations (iii) text mining of development team member. After the find the vulnerability software developer or engineers apply three major rules "vulnerabilities", "apply secure standard for coding" and "tools apply for security base on software security". Our research study results applying on IBM and gain good security results according to research. Our purposed tools and rules in the process of development and testing. Regular practices required form the team and organization this team identifies prospects for enhancement.

Khalil, M. A., & Kotaiah, B. [9, 27] Enhancement in software project development in it organization adopts emerging agile base scrum model methodology. In traditional waterfall model facing many difficulties related to software requirement. Agile methodology deal with these problems and fully satisfy to customer to software because dynamic behavior. On the behalf of the research collect data of waterfall traditional model and also new agile method for challenges, success, and failed rate of different project form 2010-16 and planned these methods through ratio to display how agile method is functioning well for emerging the different project that is achievement, challenged and unsuccessful ratio of practices are in agile (53%, 36%, 8%) while in waterfall model has (34%, 44%, 199%). Hereafter this study has collected 19 methods which can be taken maintenance at the time of development. So, we engaged a dataset interrelated to system and applied with scrum model that is axosoft which defines the sprints of projects to assign the workload of each software developer for accomplish tasks within time.

Sachdeva, V., & Chung, L. [10, 27] To adopt agile methodology is growing in software companies become most prominent methodology of development most famous methodology as extreme programming (xp) and scrum methodology that help to meet functional requirement. There is an important aspect which is nonfunctional requirement (security) mostly ignored in software development process. With the current, emphasizing to cloud and highlighting in big data in the software companies, NFRS, like security and efficiency, have more serious before. This study proposed new method to manage security and performance for software including big data, scrum model. A research, conduct over 9 months, shows the method that helps and deals with software security and individually as well between them in an agile scrum base model methodology.

Amjad, S., Ahmad, N., Saba, T., Anjum, A., Manzoor, U., [11, 28] Modifiable environment and scope in agile development is difficult to measure its completeness and worth. The purpose of this research is to point out the key elements of scope for agile software development projects and represent a technique for agile in order to calculate the excellence and completeness of the scope. The suggested technique reflects the key elements that recovered outcomes of organized literature review. A marketing analysis is conducted to authenticate these fundamentals. Function is assigned priorities base of importance in scope to generate a scorecard for score of stories existing in the product backlog. The offered technique is able to pinpoint the clear and whole user stories for applied in the next iteration. Formal experimentations are done for the assessment of the suggested method, and it advises that the technique is beneficial for professionals for calculate the completeness and excellence of scope description of agile base software development projects.

Baumeister, H., Lichter, H., & Riebisch, M. [12] Agile standard meeting and agile exercise planned for agile software team members to enhance agile improvement process. We aware about which characteristics are focusing while implementing agile methodology and in what way reflection exist in its exercise. We conduct research study involving information collected with sixteen interviews of software experts with three agile teams' members and observe of their meetings. We identified that vital characteristics focus on while the meeting consists recognizing and debating obstacles, debating feelings, studying preceding action, recognizing reasons behind the scene recognizing future points and producing a plan. We point out the agile team's member does not accomplish all planes of reflection by execution conferences. Main contributions of work to current a reflection outline by agile meetings that describes three stages of reflection with four steps of agile. Agile team can practice its outline to accomplish improved focus and best stages of reflection in their meetings. Terpstra, E., Daneva, M., & Wang, C. [13] By literature review security requirement revealed agile base projects exposed some available proposals for meet requirements of security in agile development environment. Although these suggestions recognize the crucial methods to engineer development for security in agile [31-33]. Little experimental assessment of these happened in real-world contexts. Little about developers of agile recognize security problems and them their coping approaches regarding these requirements. This paper shows an analysis that discover agile experts' objective of security, factors that reflect vital for shaping procedure of security in agile development projects, and these approaches for perfection. We accomplish with some suggestions for exercise and research. Othmane, L. B.,

& Ali, A. [14] scrum is also a form of incremental development method like scrum code changes to meet customer changing requirements.

Adelyar, S. H., & Norta, A. [30] Agile method like extreme programming and scrum are development method by

use changes in any phase of software to any clients. Though, methods analyzed as the not available of safety is an imperative goal of systems. There is existing results on this point; there is no method for point out the security problems of agile methodology. Exactly, we evaluate the agile methodologies to discover the security issues of customers and developer during development. Point out these all type challenges assistances the secure software development with agile. This research study on the base of outcomes shows that number of customers result in security challenges and software vulnerabilities.

Oueslati, H., Rahman, M. M., [32] Many challenges related to secure software development using agile discuss in this research study. By systematic literature review finds the challenges and mentions its causes with agile practices, and security practices. We point out in study almost 20 problems, which report in 28 research publications. Pointing out the 14 challenges are correct and 6 never reason of agile and principles, not the security practices. By literature review found that 2 of the correct problems related to software security development life cycle, and 4 are relevant to incremental models, 4 related to security assessment, 2 are connected with cooperation, and 2 are relevant to security. These consequences explain the essential needs for study to make secure software development. Aguda, O. A. [30] To achieve security is most critical factor of software development. Much researcher works on security and scrum! They provide some information to handle security in a scrum project. Many methodologies are available to develop software method such as traditional model like waterfall and integrate security into leading agile scrum model. Researcher think that agile scrum does not provide fully secure developed software. There are design and complete security characterized by legacy approaches providing the way to enhance sprints. Add the experiences of developer who face the issues in integration of security into scrum. Even small amount of participant included developers, scrum master development manager, scrum master development manager, business analyst, tester, and security architect. Survey was conducted by different ways e.g. video call conferencing and by phone calling. Finding show that informal methods of security direct effect on scrum security second, find that professional and personal 61 effect scrum security.

Rindell, K., Hyrynsalmi, S., & Leppänen, V. [12], in computing task and software project contain more security risk then other task. Now a day software security issue increases to past. Security becomes more crucial in some situation and circumstances in software development. In such cases required more security for development and hosting as well. To meet these conditions, use agile software development chance to improve the software effectiveness and organizational requirement. This research study proposed secure software development and management system. The software project was applied in according to the government security processes, although this software development service

provider's use self-organized software management outline with scrum. Software project navigation the develop to requirement for scrum. This scrum base software project viewed as guidance of scrum. We a careful the problems of fulfilling the security rules related to development process and product for user. Assessment of effects of security and cost is also accessible.

Oyetoyan, T. D., Cruzes, D. S., & Jaatun, M. G. [21] Every organization having a priority to protect their businesses and assets form unauthorized access. To achieve security goals taken bold step to protect asset of business. By using agile development environment not fully support security related values. So agile team member achieve security by their own. To achieve security with agile become important to understand the software security practices performed by agile team. In research, use analysis to investigate the software development security, ability, and exercise needs in agile base organizations. We investigate (i) the different companies achieve differently security deeds but similar activities could be a leverage for software security (ii) nevertheless of cost benefit, different kind of actions that are done (iii) secure software design is stated as the important exercises required from all in agile development organizations (iv) actual software development security adopt in agile is not automate. Purpose of this research is experimentally study how work agile development team and handle security testing in their agile projects, purpose to point out basic aspects manipulating the test of security needs, precisely security in agile software development. We show meetings with 20 it experts in large organization. As conclusions we point out six main points manipulating non-functional requirement and three basic experiments adopt by researcher to handle the problems. Aim to duplicate study in larger. Temporarily, research work offers to originate participation to experts and motivates our more research. Gold, B., & Vassell, C. [20, 21] Three main factors are discuss in scrum risk management properly balance. criteria with the pre-exist agile conditions. After that, by survey, agile development process security events are point out and calculated by experts from famous organizations of telecommunication and software. These events are matched, and unambiguous security process is optional for agile base process that will deliver major benefits with low implement cost. Ben Othmane, L., Angin, P., Weffers, H., & Bhargava, B

[19] The agile development method best development method but agile development secure software development problems. Present methods for agile process, which allows iterative development, collapse short of give a way for professionally

Study about limitation and benefits that faced while application of risk management as a proper way during agile base scrum project. Other ways that can be used to manage risk effectively in scrum base projects. Methods of discussion with scrum expert emphasis mainly UK base its experts. How they deal risk in agile base scrum model. Data analysts expose that most software business using scrum that not apply risk plan for projects underneath the assumption that agile of scrum mitigate risks management, but all respondents decided that it would most probable introduce the other risks might affect the goals of the projects. Adelyar, S. H. [22] For secure software development, agile think to be an inadequate. Currently, only few studies conduct on the agile security for agile base models. Their additional universal method is to point out security benefits and barriers of agile base scrum model practices that interrelated to the basic "embrace-changes" standard. This research study purely based on literature review, considering extreme programming for a universal software security addition into software development technique agile base scrum model practices [23]. Although, they are considered as tuff to express, and in software development agile, are almost give low priority and frequently not documentation. In this research study, we are presenting the results of the practices and barrier of non-functional requirements in organization utilizing agile software development and recommend rules for improving non-functional requirements documents in agile software development. We conduct interviews of experts from three organizations to point out that option, user stories, features, approval criteria, acceptance scope, definition of done, sprint backlog are used for documentation non-functional requirements. Word documentation and spreadsheets are used for non-functional requirements documenting. In small organization, non-functional requirements relate to white-board and flip-chart developers' knowledge is arranged with

certification [20]. compare most accepted waterfall engineering progression with enhance the security reasons claim the security in incremental product created at the end of every increment. This research study is a propose a way for security insurance of iterative it through normal case study. Addition of security activities in the agile development environment and practices the reliability method to make sure creating adequately secure for the professional. Software built at the completion of each increment and converse compliance the planned way with agile standards and its capability to create secure increments of software. The detail literature review can be concluded as described in figure2, takes from [6].

Figure 2: The detail philosophy working of scrum model with its delivery, adoption, methodology and management section:

III.   PHASES OF SCRUM METHDOLOGY

for our research work because scrum is widely use and considered to be a good development model in the software to achieve our goal to build secure software, we will adapt scrum methodology as discussed in figure 3. Agile consists of different development model like Crystal Family Method [1, 9], Extreme programming, Feature-driven methodology and scrum methodology among them we must choose scrum model development industry and fulfill the stakeholder's needs excluding Security. We will create an information security model that deal with security and business security issues. Information security model will work with the integration into scrum model. By merging this feature on scrum model scrum can make more reliable model for software development. Apply this new model on emerging security issue and develop new software under this scrum model methodology. For the best resulting IS model work combine with existing scrum model. Check its efficiency by applying on different case studies and check its validity by conducting questioners to software experts. Then this model can be revised for batter providing information security.

A.   Planning Phase

Figure **2** provides graphical representation and overview of our research study. The research planning phase includes literature review of software security and information security literature. By review of software security literature find a security gap. There are many reasons of software failure like wrong time estimation, wrong cost estimation and security blackness. By literature review we found there are major issue of software failure, software security that lead to failure. In software development there are several methods that are used in software development. Agile is a famous software development method. Agile is based on iterative development that welcome to client's changing requirements. Different software development methodologies are based on agile; scrum is also one of them. We will try to overcome these security issue by using information security. we conduct literature review of information security and its practices.

After that we implement according to information security measures with scrum model that will enhance security in each phase of scrum.

B.   Conducted Phase

In this phase, we will integrate the security practices with scrum model. We must introduce new role named information security master that will in enhance the security in software development model. ISM will identify, manage and prioritized security requirements. Scrum generally deal with small software projects, while in large software projects security issues are ignored because there is no security related team member involve overcoming the security concerns. Our new inclusions will deal the security requirements in every phase of scrum development without disturbing the agility of the scrum model.

C.   Reporting Phase

Our study will base on mix method research methodology. By distributing questionnaire to participants, we will be getting feedback about purposed information security base model. And at the end, we will conclude the research with results. Describe our contribution and future work to improve more security of software developmental model.
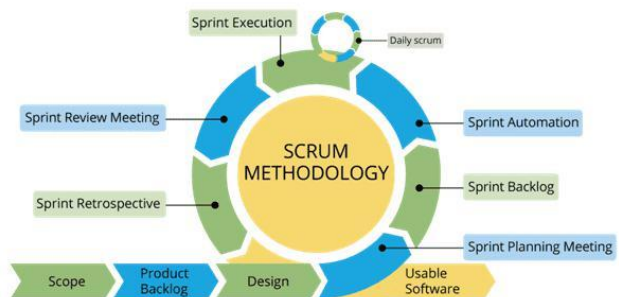

Figure 3: The improving Scrum Methodology

IV. PROPOSED APPROACH

There are many methods proposed to integrate security with scrum development process. Our proposed approach deals with software security by using information security practices (IS). Product backlog are analyzed by using IS Practices approach and point out specific product backlog for development. This method does not take much time and delay in the development process with IS practices in scrum software development environment. IS practices enhances the simplest scrum model into secure scrum model is more appropriate. This process is the simplest and lightest way to secure scrum. Product security is automatically ensured in the scrum model by putting deep attention on secure development process. In scrum the first phase is planning phase, and, in this phase, proper planning is done between product owner and client. The model hierarchy of our propose system is depicted in figure 4 where different IS masters explained the overall procedure of using improved scrum with its testing and releasing backlog.

A. Information security Backlog

If we talk about management of security activity in product backlog, security activity in the product backlog of current scrum model does not fully deal with the security perspective. To resolve this issue, we will create extra backlog that's called IS backlog this extra backlog will helpful to managing security related issues and will reduce security risk. With the help of IS backlog the security risk will be minimizes. With inclusion IS backlog, product feature backlog will be made more secure. In this way of security management, it is ensured that no single security feature is skipped.

B. Information security Master

A new role is also added in scrum model named "information Security Master" take from [13] that having deep knowledge related to security and information security backlog. IS master will manage Information security backlog. All security feature in IS backlog mentioned by IS master will be process as other processes.

C. Information security backlog for requiremnet section

The additional backlog named IS backlog is added in scrum model. IS backlog will check all product backlog features and IS master point out the specific feature required more security. As mentioned earlier that all product backlog go through with IS security backlog. In a specific backlog, security master will decide which IS requirements feature will

be added. A security documentation will be prepared by IS master of its all IS backlogs in development phase. In IS model in scrum the documentation is to be simple and precise not complex like other security system Systems Security Engineering Capability Maturity Model. This precise and comprehensive documentation will help the developer to apply all IS feature and overcome any type of security risk.
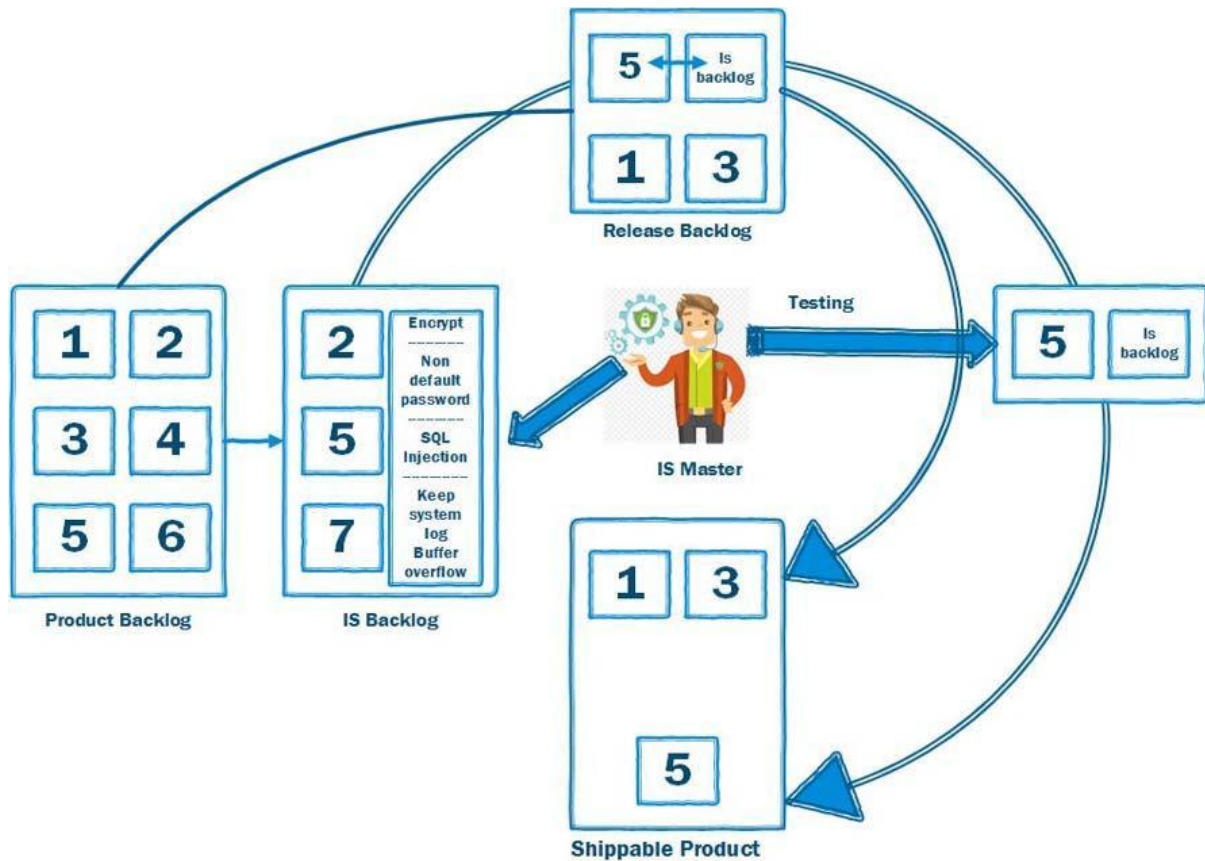
D. For development section

IS master will create and mark the specific security feature and then derived security feature will be forward in sprint backlog for development. Certain security requirements will be forward to with the security backlog to the developer. IS backlog will be mentioned which security feature will get more attentions of developer. First phase of planning IS backlog is process and further phase is release backlog phase and sprint prioritized feature develop in this phase. IS backlog will help to development team and user to converse about IS requirement of specific feature.

E. For testing section

IS backlog meet the quality standard principle to make it clear that vulnerabilities do not exist in software and make is also sure that not any type of risk attached with software. And security testing will be performed in testing phase by security master. A security documentation will be prepared by IS master of its all IS backlogs in testing phase [22-24]. IS relevant to technical knowledge to find out and minimize the risk of security. Here are we will suggest training and education related to IS and how to IS to developer to develop secure and stakeholders to well-known related issues.

V. SURVEY-BASED DEMOGRAPHIC INFORMATION-BADED RESULT

We conduct empirical study with questionnaire form the participants project manager, Director I.T, System Architect, Business Analyst, Senior software engineer, Software developers. The limited define their experience between different level of experiences 1-5 year, 6-10 year 11-15 year and 15+ and they also define last completion of project from web base software, system software, desktop application and

Figure 4: IS Master with its relation of different section

mobile application, and embedded software furthermore they define software development processes like extreme programming, Scrum methodology, V-model, feature driven development, Rapid application development.

In figure 5, the overall professional designation of the participant in the organization. The results showed that 24.6% belong to software developer designation while 23.1 % belong to Business analyst, 13.8 % Senior Software developer respond, 12.3 % participant belong to System analyst designation, more ever 10.8 % participant belong Project manager designation while 7 % belong to scrum master and remaining 7 % belong to Scrum master designation.

This question is about the participant that are given their feedback for professional experience questionnaire, how long they work on their designation, having experience in professional career. The results show in figure 6, that participant most belong to 6-10-year experience in development field as mentioned 32.3 % in diagram. Second most experience 27.7 % belong to 1-5-year experience, some participant having experience with 21.5 % while 15.4 % participant having 15 year plus experience and remaining part 3.1 % participant having 0-1-year experience.

In this question of questionnaire, about the participant that will provide answer, which type of last completed of software

project the results show in figure 5.3 that 26.2 % experts develop system software, 24.6 % lastly completed Desktop application project more ever 20 % participant belong to the Mobile Application projects while 16.9 % that belong to develop Web base software some recently completed and although ramming part of participant 12.3 % belong to embedded software projects as shown in figure 7.

This question is about to know the participant that provide answer of last completed project, in these projects which methodology they adopted. There is some agile base model mentioned Xp, scrum, V-model, FDD and RAD [53]. Above mention figure 5.4 results show that mostly 60 % participant belong scrum methodology farther more 12.3 % adopt v-model more ever 11 % participant about Feature driven development methodology while 10.8 % adopt extreme programming and only 5.9 % participant use Rapid application development as represent in figure 8.

The reason to ask this question to know the participants point of view related to Information Security Policy (ISP) [23]. How much percent participant are well known to information security policy? In figure 9, results show that 58.5 % participant are agree with the policy of information security. There are 18.5 % participants are strongly agreed about the awareness of information security policy. Furthermore 12.3 % participants are neutral about the awareness of information

security While 6 % participants strongly disagree and only 4.7 % participants disagree about the question.

The researcher wants to know the participant that will be the part of our research having a knowledge of information security. Our research enhances the security required by using information security so that is why it is very important that the participant should having knowledge of information security. Our results show that in figure 5.6 the 58.5 % participant agree our question mean they well aware to information standard furthermore 18.5 % participant strongly agree to information security practices more ever 12.3 % answer as neutral about information security practices while 7 % participant Strongly disagree about information security practices question and only 3.7 % participant answer as disagree related to this question as in figure 10.

The questionnaire was planned to validate the addition of role IS master and IS backlog having moral outcome on scrum process in the form of security [33]. By using questionnaire this hypothesis will be verified, the results come from questionnaire show that addition of IS master and IS backlog give positive impact on security requirement which comprised modeling, prioritizing and identifying software security requirements, when conduct empirical study there are different groups of participants. These result show that IS scrum model having a positive effect on team member for sort-out security requirement as mentioned in figure 11.

This question is about suggestion to add, information security backlog in scrum model, the researcher want to know about the significance of information security backlog in software development. Is it remain helpful in develop or not? Our results in figure 12, show that 38.5 % experts strongly agree that information security backlog helpful for managing software requirement. Furthermore 26.2 % agree remain helpful for managing software requirements more ever 24.6 % participant neutral about it while 6 % participant strongly disagree with and remaining 4.7 % participant disagree about the information security backlog help.

The researcher wants to know in this question information security backlog play vital role to for priorities the security requirement while development the software project. It remains helpful to find out the specific security requirements and priorities the security requirements. In figure 13, show that 38.5 % participant strongly agree with the addition of information security for priorities the security requirement furthermore 26.2 % participant agree with the question more ever 24.6 % participant are neutral while 6 % strongly disagree about question only 4.7 % expert's thing it is no vital for priorities for security requirements.

This question is about to know, managing security by using information security backlog, the researcher wants to know about information security backlog effectively manage security requirement in software development. Is it remain

helpful in develop or not? Our results in figure 14, show that 38.5 % experts strongly agree that information security backlog helpful for managing software requirement. Furthermore 26.2 % agree remain helpful for managing security requirements more ever 24.6 % participant neutral about it while 6 % participant strongly disagree with and remaining 4.7 % participant disagree about the information security backlog efficiency in development.

In this question research want to know information security backlog helpful for easy to model security requirements. Figure 15, results show that 40 % participants strongly agree furthermore 26.2 % are neutral more ever 23.1 % participant think it is helpful and easy for modeling security requirement by using information security backlog and answer as agree. While 5.2 % participant answer as strongly disagree only 4 % experts answer as disagree to this question.

This question is about, information security backlog proven as helpful while software development. Information security backlog provide help to maintain security requirement during development. In figure 16, show that 40 % participant strongly agree with the inclusion of information security and remain helpful in development. Furthermore 26.2 % are neutral more ever 23.1 % participant think it is helpful in development maintain security requirement by using information security backlog and answer as agree. While 5.2 % participant answer as strongly disagree only 4 % experts answer as disagree to this question.

VI. EFFECTIVNESS OF INFORMATION SCEURITY MASTER

This question is about addition a new role in software development model. Is information security master helpful for identify software security requirements? Results are shown in figure 17 participants give answer as strongly agree with the inclusion of information security 47.7 % part belong to this. Furthermore 20 % participant agree with information security master help. More ever 20 % neutral about this while 6.3 % participant disagree only 6 % participant strongly disagree with the help of information security master to identify security requirement.

This question is about addition a new role in software development model. Is information security master helpful for modeling software security requirements? Results are shown in figure 18 participants give answer as strongly agree with the inclusion of information security for modeling security requirement 46.2 % part belong to this. Furthermore 21.5 % participant agree with information security master help for modeling security requirement. More ever 20 % neutral about this while 6.3 % participant disagree only 6 % participant strongly disagree with the help of information security master to modeling security requirements.

Purpose of this question in questionnaire to make it clear, the team with the help information security master implement security into product. this is important task in development our
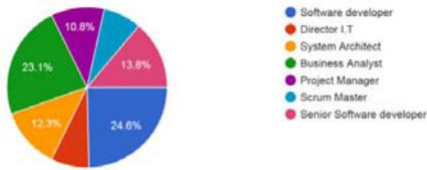
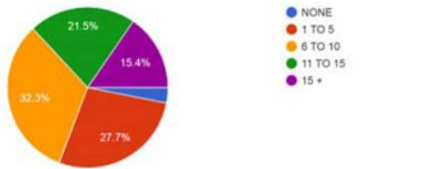**Figure 5:** Overall professional designation in the organization

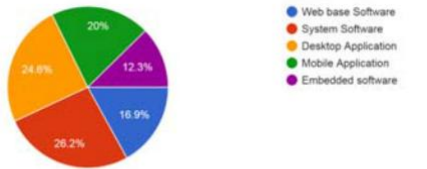**Figure 6:** Feedback for professional experience

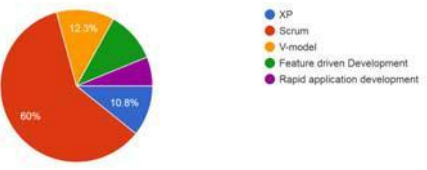**Figure 7:** Last completed of software projects

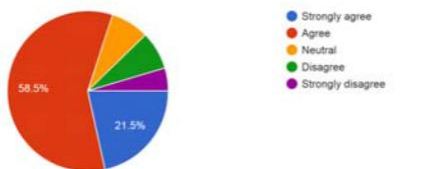**Figure 8:** Methodology they adopted in Last Projects
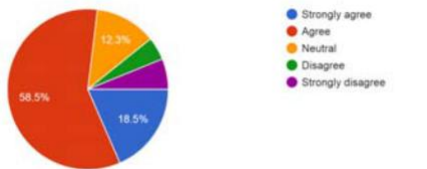

Figure 9: Participants point of view related to ISP
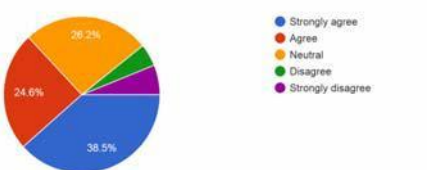

Figure 10: Security required by ISP
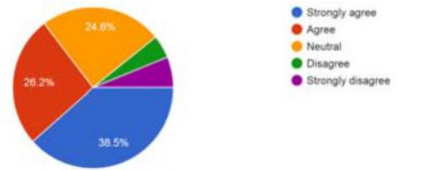

Figure 11: Role of IS master and Backlog

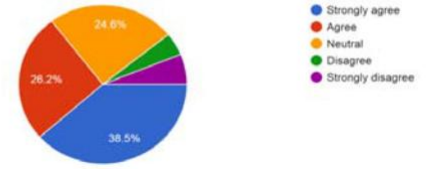**Figure 12:** Information security backlog in scrum model

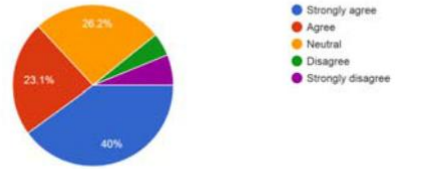**Figure 13:** Addition of IS for priorities of participants
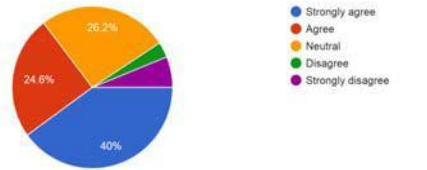

Figure 14: Managing security by using IS backlog

Figure 15: IS backlog for security requirements

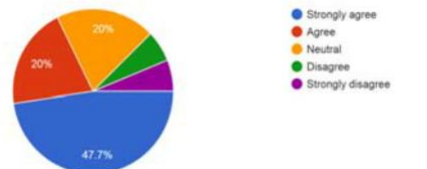**Figure 16:** IS security requirement during development

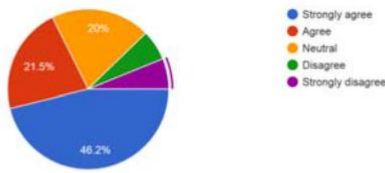**Figure 17:** Effectiveness of IS master for IS requirements

Figure 18: Inclusion of IS for modeling security requirement

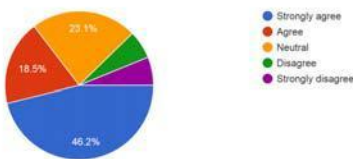**Figure 19:** Effective advice about security requirement

Figure 20: Satisfaction level of IS master's in development model

results show that 46.2 % participant strongly agree with furthermore 21.5 % agree with this more ever 20 % participant remain neutral while 6.3 % participant disagree with this only 6 % strongly disagree with the inclusion of security master for this purpose. In this question researcher want to know related to information security master that play vital role in or information security practice base model. Is this role provide success to find out security requirements or team member getting more effective advice to sort out security requirements with the help of information security master? Our results in figure 19 show that 44.6 % experts strongly agree about effective advice about security requirement. Furthermore 23.1 % neutral about effective advice about security requirement more ever 20 % participant agree about it while 6 % participant strongly disagree with and remaining 6.3 % participant disagree about effective advice about security requirement gathering. This question is about to know, the participant how much satisfied from the addition of information security master's in development model. Are the participant and other team members enable effectively negotiate related to security requirement with information security master? In figure 5.16 show that 47.6 % participant found that they effectively negotiate security requirements with information security master and answered as strongly agree. Furthermore 23.1 % participant found that they effectively negotiate security requirements with information security master and answered as neutral more ever 18.5 % participant found that they effectively negotiate security requirements with information security master and answered as agree while 6 % participant found that they effectively negotiate security requirements with information security master and answered as strongly disagree and remaining 6.2 % are disagree with the question.

VII. CONCLUSION

Agile consists of different development model like crystal family method, extreme programming, feature-driven methodology and scrum methodology. With the passage of time to secure the software process is become a challenge in software industry. Where agile methodology is growing due to easy and friendly environments side by side security of software is emerging issue of agile development. Therefore, from review the existing study, we found a security gap in scrum framework and extend the scrum model by inclusions information security practices that can improve scrum model to resolve security issues. In this paper, we make a new addition of information security practices by adding the information security backlog and information security master in existing scrum framework to capture security requirement more smoothly. For checking validity via conducting empirical study from professional to get their expert opinions about security practice of scrum model. These results show that there was need of information security owner role that have a sound knowledge and expertise to facilitate in better way.

VIII. REFERANCES

1. Sharma, S., & Hasteer, N. (2016, April). A comprehensive study on state of Scrum development. In *2016 International Conference on Computing, Communication and Automation (ICCCA)* (pp. 867-872). IEEE.
2. Perkusich, M., de Almeida, H. O., & Perkusich, A. (2013, March). A model to detect problems on scrum-based software development projects. In *Proceedings of the 28th Annual ACM Symposium on Applied Computing* (pp. 1037-1042).
3. AL_Zaidi, A. S., & Qureshi, M. R. J. (2014). Scrum practices and global software development. *International Journal of Information Engineering and Electronic Business*, *6*(5), 22.
4. Paulk, M. C. (2013). A scrum adoption survey. *Software Quality Professional*, *15*(2), 27-34.
5. Anwer, F., Aftab, S., Shah, S. M., & Waheed, U. (2017). Comparative Analysis of Two Popular Agile Process Models: Extreme Programming and Scrum. *International Journal of Computer Science and Telecommunications*, *8*(2), 1-7.
6. Khalid, A., Butt, S. A., Jamal, T., & Gochhait, S. (2020). Agile Scrum Issues at Large-Scale Distributed Projects: Scrum Project Development At Large. *International Journal of Software Innovation (IJSI)*, *8*(2), 85-94.
7. Srivastava, A., Bhardwaj, S., & Saraswat, S. (2017, May). SCRUM model for agile methodology. In *2017 International Conference on Computing, Communication and Automation (ICCCA)* (pp. 864-869). IEEE.
8. Sharma, S., & Hasteer, N. (2016, April). A comprehensive study on state of Scrum development. In *2016 International Conference on Computing, Communication and Automation (ICCCA)* (pp. 867-872). IEEE.
9. Lous, P., Kuhrmann, M., & Tell, P. (2017, May). Is scrum fit for global software engineering?. In *2017 IEEE 12th International Conference on Global Software Engineering (ICGSE)* (pp. 1-10). IEEE.
10. Anwer, F., Aftab, S., Shah, S. M., & Waheed, U. (2017). Comparative Analysis of Two Popular Agile Process Models: Extreme Programming and Scrum. *International Journal of Computer Science and Telecommunications*, *8*(2), 1-7.

11. Perkusich, M., de Almeida, H. O., & Perkusich, A. (2013, March). A model to detect problems on scrum-based software development projects. In *Proceedings of the 28th Annual ACM Symposium on Applied Computing* (pp. 1037-1042).

12. Ahmad, M. O., Kuvaja, P., Oivo, M., & Markkula, J. (2016, January). Transition of software maintenance teams from Scrum to Kanban. In *2016 49th Hawaii International Conference on System Sciences (HICSS)* (pp. 5427-5436). IEEE.

13. Zorzo, S. D., De Ponte, L., & Lucredio, D. (2013, October). Using scrum to teach software engineering: A case study. In *2013 IEEE Frontiers in Education Conference (FIE)* (pp. 455-461). IEEE.

14. Kumar, G., & Bhatia, P. K. (2014, February). Comparative analysis of software engineering models from traditional to modern methodologies. In *2014 Fourth International Conference on Advanced Computing & Communication Technologies* (pp. 189-196). IEEE.

15. Kuhrmann, M., Diebold, P., Münch, J., Tell, P., Garousi, V., Felderer, M., ... & Prause, C. R. (2017, July). Hybrid software and system development in practice: waterfall, scrum, and beyond. In *Proceedings of the 2017 International Conference on Software and System Process* (pp. 30-39).

16. Lous, P., Kuhrmann, M., & Tell, P. (2017, May). Is scrum fit for global software engineering?. In *2017 IEEE 12th International Conference on Global Software Engineering (ICGSE)* (pp. 1-10). IEEE.

17. Adnan, M., & Afzal, M. (2017). Ontology based multiagent effort estimation system for scrum agile method. *IEEE Access*, 5, 25993-26005.

18. Ashraf, S., & Aftab, S. (2017). IScrum: An improved scrum process model. *International Journal of Modern Education and Computer Science (IJMECS)*, 9(8), 16-24.

19. Ghani, I., Azham, Z., & Jeong, S. R. (2014). Integrating Software Security into Agile-Scrum Method. *TIIS*, 8(2), 646-663.

20. ben Othmane, L., Angin, P., & Bhargava, B. (2014, September). Using assurance cases to develop iteratively security features using scrum. In *2014 Ninth International Conference on Availability, Reliability and Security* (pp. 490-497). IEEE.

21. Ali, T., Yasin, S., Draz, U., & Ayaz, M. (2019). Towards formal modeling of subnet based hotspot algorithm in wireless sensor networks. Wireless Personal Communications, 107(4), 1573-1606.

22. Draz, U., Ali, T., Yasin, S., Waqas, U., & Rafiq, U. (2019, February). Towards Formalism of Link Failure Detection Algorithm for Wireless Sensor and Actor Networks. In 2019 International Conference on Engineering and Emerging Technologies (ICEET) (pp. 1-6). IEEE.

23. Ali, Tariq. (2019). A Comprehensive Formal Testing of Few Attacks on Mobile Adhoc Networks By Using VDM-SL Tool Box. International Journal of Computer Network and Information Security. 19. 116-126.

24. Draz, M. U., Ali, T., Yasin, S., & Waqas, U. (2018, December). Towards formal modeling of hotspot issue by watch-man nodes in wireless sensor and actor network. In 2018 International conference on frontiers of information technology (FIT) (pp. 321-326). IEEE.

25. Yasin, S., Ali, T., Draz, U., Jung, L. T., & Arshad, M. A. (2018). Formal Analysis of Coherent Non-Redundant Partition-based Motif Detection Algorithm for Data Visual Analytics. J. Appl. Environ. Biol. Sci, 8(2), 23-30.

26. Rasool, G., Aftab, S., Hussain, S., & Streitferdt, D. (2013). eXRUP: A Hybrid Software Development Model for Small to Medium Scale Projects.

27. Jabbar, A., Iqbal, S., Khan, M. U. G., & Hussain, S. (2018). A survey on Urdu and Urdu like language stemmers and stemming techniques. Artificial Intelligence Review, 49(3), 339-373.

28. Hussain, S., Erwin, H., & Dunne, P. (2011, September). Threat modeling using formal methods: A new approach to develop secure web applications. In 2011 7th International Conference on Emerging Technologies (pp. 1-5). IEEE.

29. Hussain, S., Rasool, G., Atef, M., & Shahid, A. K. (2013). A review of approaches to model security into software systems. Journal of Basic and Applied Scientific Research, 3(4), 642-647.

30. Hussain, S., Mirza, M. S., & Malik, K. A. (1999). Production of phytohormones by the nitrogen fixation bacteria isloated from sugarcan. Biohorizons, 2(124), 61-76.

31. Hussain, S., Rasool, G., Atef, M., & Shahid, A. K. (2013). FDMSWAP: Formal Development Methodology for Secure Web Applications. Journal of Basic and Applied Scientific Research, 3(4), 1123-1128.

32. Rasool, G., & Hussain, S. (2012). Creat: Customizable reverse engineering abstraction technique. World Applied Sciences Journal, 19(10), 1453-1461.

33. Akhtar, N., & Hussain, S. (2019). Formal modeling of a mail transport system based on multi-agent system-of-systems. Journal of Information Communication Technologies and Robotic Applications, 68-79.

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