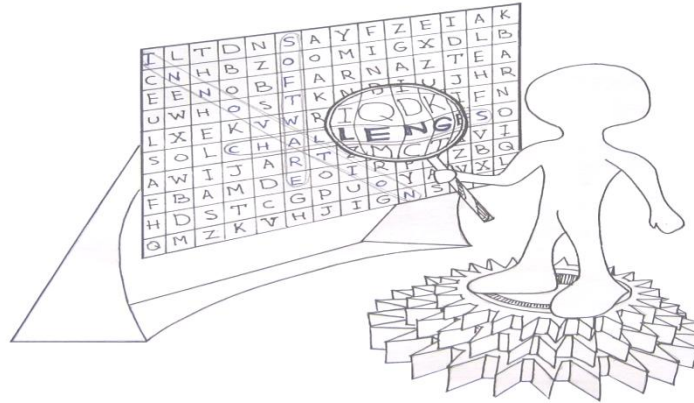**UNIVERSITY OF GOTHENBURG**

Innovation Assessment Challenges In Software Development Projects Within IT Start-ups

Bachelor of Science Thesis in Software Engineering and Management

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Cover: The artwork designed for this thesis to visualize the Research Question in P.3. The customized design has been conducted by Farnaz Jahandideh, Master in Architecture Engineering. Email: f.jahandideh@qiau.ac.ir

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Innovation Assessment Challenges In Software Development Projects Within IT Start-ups

Bachelor of Science Thesis in Sofware Engineering and Management

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Abstract— this research has been conducted to investigate challenges during innovation assessment in software development projects. Successful products based on innovation are a driving force for growth of IT start-ups. Innovation assessment process is an essential step for increasing chance of developing successful products from innovative ideas. The focus of this paper is on innovation assessment within IT start-up companies to highlight challenges on their processes. Such processes apply on ideas before development of them as new products into the market. This research is qualitative and conducted by using in-depth interviews with four entrepreneurs and co-founders in four different IT start-ups. Analysis of the data has been conducted by thematic analysis. The result presented current challenges in five different themes. These highlighted themes may clear a roadmap for improvement of assessment processes in software innovations. This research could be an area of interest for developing a customized framework in innovation assessment for IT start-ups.

Keywords—Software Engineering; Software Entrepreneurship ;Information Technology (IT) Start-ups; Innovation Assessment; Software Development; Software Innovation, Assessment Challenges, IT Innovation

I. INTRODUCTION

According to Kong, Zhang and Liu (2008) innovation is the main driving force of sustainable growth in enterprises. Specifically, innovation is about applying new positive change in four dimensions. These dimensions are product, process, position and paradigm (Bessant and Tidd, 2011). Such changes can help companies which produce products or services to meet new requirements and achieve more competitive advantages. Hence they perform at a higher level than others in industry. Therefore success and growth of enterprises depends on how innovative they are in the market (Bessant and Tidd, 2011). It has been argued that failures in innovative software projects are directly related to understanding of potential and risks within an idea (Azizi and Hashim, 2010). Hence accurate assessment process of a novel innovation concept, which fits industry needs, is a critical subject matter to investigate. The underpinning idea is that a framework that assesses and places an innovative idea through

several processes is likely to reduce uncertainty and provides a basis for managing innovation as well as yielding a higher return on investment (Andersson, et. al., 2011). On the other hand, software start-ups which are the center of focus in this research have their own characteristics such as resource constraints, market positioning difficulties and organization flexibility (Sutton, 2000). From this point of view, there is a need to explore and identify the challenges that currently involves in assessment processes within software start-ups. Such start-ups are mainly working with innovations. This assessment process applies before development of new software products. Therefore exploring current innovation assessment procedures in such start-ups and finding challenges and difficulties on their innovation assessment could be a roadmap for improvement in the area of innovation assessment processes and may help to create a customized framework to empower and facilitate such process in IT start-ups as future steps.

A. Research Aim

The aim of this research is to investigate challenges with current processes in innovation assessment which experienced by entrepreneurs in IT start-ups. Hence, the focus in this study is start-ups which founded and driven by young professionals. In light of this, the Research Question (RQ) guiding the research is: *What are the challenges of innovation assessment process in IT start-ups for software projects by young professionals?* The answer of this research question, may pave the way for achieving a better understanding of the difficulties and issues that need to be covered during assessment process.

B. Thesis Outline

The remainder of this paper is structured as follows: section 2 covers the related research about software start-ups, innovation assessment and role of processes in IT start-ups. The study followed by section 3 where the research methodology and method of analysis is outlined. Section 4 presents result of the analysis and Section 5 discusses the

findings. The last two sections give suggestions for future research and present the main conclusions of the research.

II. RELATED RESEARCH

Start-ups are special type of enterprises. They are different from other organizations. Start-ups are small but different from small-sized and established enterprises in terms of business goals, achievements and vision. For instance while established and larger enterprises develop new products to expand their market presence and their brands, start-ups struggle to begin their revenue stream from their innovations. They are not also similar to well-established and large enterprises in terms of available resources, flexibility and market presence for their products (Gruber & Henkel 2004).

Main characteristic in start-ups is that they are facing resource limitation more than other enterprises. These resource constraints are regarding skills, experiences in new venture creation, product development, limited human resource accessibility and capital constraints. These mentioned constraints affect ability of founders for growing their start-ups in terms of revenues and market achievements (Gruber & Henkel 2004).

One of the valuable assets in such enterprises is their products based on innovations. The other valuable asset in start-ups is their human resource whom involve in product development (Sutton 2010; Zhang and Liu 2008).

Enterprises including IT start-ups are focusing on innovations to produce better products with considerable competitive advantage. Such innovation could gain better return of investment and offer better market place for their enterprises (Yague et al., 2014). In light of this, start-ups are in higher tension to put more efforts on developing new products which have considerable innovation values. These values would be called "success factors". Existence of such factors could have positive impact on market presence of start-ups. Evaluation of such factors in each innovation is part of the assessment before development among start-ups. Identifying and improving such values in each idea could increase the chance of developing better products. Such product could ensure enterprise existence and would help them to grow in the competitive IT market (Hang et al., 2010).

Since risk of failure and breakdown is higher in start-ups in compare with other well-established enterprises. Therefore role of innovation is more important in such enterprises. Hence understanding of the weaknesses and strengths of their innovation is really important to ensure the return of investment and reduce uncertainty and risk for failure of the final product (Hang et al., 2010).

Each start-up and their entrepreneurs have their own procedure and approach in assessing their innovations before product development. This means that according to their earlier experiences, skills, business goal and aims, each start-up using their own process on estimating the position of their novel innovation in the market. Based on the result of such assessments, entrepreneurs would decide about putting effort on development of their idea into a commercial product (Sutton 2010; Yague et al., 2014).

Larger and well-established enterprises would face some challenges and difficulties during innovation evaluation process. Such difficulties are including finding of relevant data for market positioning, involving reliable participants or designing the evaluation process (Hang et al., 2010). These challenges show that such difficulties could be existed in start-ups as well. Hence identifying them is critical for creating a framework for assessing innovations in IT start-ups. Such a framework may become a standard format for assessment innovation process among start-ups (Yague et al., 2014; Hang et al., 2010).

TongShi and JiShunZhu (2010, p.497) suggest in their study about assessment frameworks in software development processes that "people are the most important ingredient of success" in assessments. They further suggest that, a ''good process will not save the project from failure if the team does not have strong players; but a bad process can make even the strongest of players ineffective'' (TongShi and JiShunZhu, 2010, p. 498).

According to Yague et al. (2014) there are several processes for assessing product capabilities and product development in larger enterprises. Nevertheless none of them could meet all the requirements for fulfilling the need for innovation assessment in their enterprises.

Larger enterprises have more capital and in-market brands. These enterprises are more flexible to apply new products in the market. They are using different processes for their prospective product evaluation. In light of this, larger enterprises use different frameworks for organizational improvement. In light of this, for instance Capability Maturity Model (CMM) consists of five maturity levels i.e. "initial, managed, defined, quantitatively managed, and optimizing" (Saikh et al., 2009; Sutton 2010). From this point of view, CMM provides processes in "software development and maintenance" (Drew, 1992, p.137). In such process, enterprises are using in-site survey to consider the validity of a prospective product from participants in different working levels (e.g. from developer to designers).

Applying such framework in enterprises could be beneficial for creating an environment to produce better innovative ideas. Such ideas could be developed to become prospective products with capability to get better position in the market. At last, this could increase the organizational innovation capability (Rodriguez et al., 2014). Nevertheless in compare to larger enterprises, such framework is not used widely as part of idea development in start-ups due to their early establishment.

On the other hand, there are several studies regarding using of development processes in different enterprises. For instance there are proposed procedures in Software Process Improvement (SPI) which could be used in start-ups. Such process would highlight the role of development processes in the area of product development. According to characteristics of start-ups including their resource accessibility, the role of agile processes and SPI is important for being flexible to change. Such change would be required based on customer

needs or market shift (TongShi and JiShunZhu, 2010; Sutton 2010).

Such processes are not directly related to innovation assessments before development. Nevertheless some features in the area of SPI such as "Speed, Quality, Flexibility, Proactively and Improvement" (TongShi and JiShunZhu, 2010, p.499) could be considered in assessment processes. It means that such features could be used in evaluation of the capability of related frameworks in enterprises.

Additionally in compare with large and well-established enterprises, software start-ups are not able to produce different products or innovative prototypes at a time. They cannot even tolerate market shift as easy as larger enterprises can do. Hence start-ups are in need to be more certain about potential of their innovations and their value propositions before development of ideas.

In light of this, start-ups required to put more effort on innovation assessment. The reason behind this effort is that the prospective product from each idea is the core of revenue stream and growth of start-ups. Therefore they need to find a proper approach for evaluation of their innovations. Such approach would be used as an assessment process of innovations. The assessment result should find positioning of prospective products in the market (Yague et al., 2014).

This research conducted by studying similar researches which are related to several similar frameworks and evaluation processes. These frameworks and evaluation approaches are directly related to evaluation of capabilities in innovations and would show importance of proper process in start-ups. These related frameworks consist of studies including: Disruptive innovation assessment framework (Yague et al., 2014; Hang et al., 2010), Open innovation empirical analysis (Gruber and Henkel, 2004), Analyzing software product innovation assessment (Yague et al., 2014) and Studying role of software processes within software start-ups (Sutton, 2010).

The motivation for selecting these researches as main area of interest for consideration in this study is that their concept and processes are at the same research area as this study defined. The selected study worked with several approaches for innovation assessment and evaluation of novel ideas. The basis of assessment and evaluation approaches for innovations in the selected studies could be used in all type of enterprises such as start-ups.

The related researches and the given examples showed there are studies regarding the role of development processes and innovation evaluation in enterprises. The studies highlighted this fact that the characteristic of start-ups and the scale of their ideas need more attention and research. Such studies required to find out the difficulties that these specific types of IT firms face during their assessment. Hence this study could correspond to the need for proper assessment process for evaluation of small and innovative software projects.

Additionally, there were studies regarding the specific features in IT start-ups and the role of processes in development of their organizations and managing the resources to get better outcome from their prospective products.

For instance, according to Sutton (2010) defining or choosing right process has a big role in start-up development. Choosing right process could be considered in different dimensions. Such process is required for evaluation of ideas as well as implementation process for product development. For example, choosing an approach which could assist entrepreneurs in a more organized way and within different formalized stages for evaluation of the product or ideas could make higher chance of getting better market place. On the other hand, it would help the company to be flexible in confronting changes and shifts in the dynamic IT market (Sutton 2010; Andersson, et. al., 2011).

Additionally as an example, in Hang et al (2010), there is an innovation assessment framework which is designed to enhance the specification of the prospective products. This framework is designed based on identified factors. These factors considered as "success factors". Fulfilling of these factors is directly related to failure or success of an innovation. These factors consist of variables in regards to "market positioning, technology and other favorable drivers" (Hang et al., 2010, p.3). These identified factors would be evaluated by a defined questionnaire from participants. The aim for using such framework is to improve innovative software projects within its staged processes before development. Such framework could improve organizational performance through gaining better market place at last (Yague et al., 2014).

The studied literatures would clear an approach for identifying assumption of existing challenges in IT start-ups. Such challenges could be existed for proceeding with innovation assessment. This assumption has been identified through analyzing similar studies. These studies are about the need for assessment of an innovation before development and identifying the market needs to be agile in confronting industry shifts. Nevertheless since there is no specific formalized process or designed framework which is customized for IT start-ups in their innovation assessment process, they could have confronted some issues during their evaluation and assessment process.

The previous studies related to RQ, highlighted set of relevant features which should be measured by questionnaire (see Appendix-1). Such questionnaires are a well-known approach to be distributed among young entrepreneurs in IT start-ups for finding out challenges involves during their innovation evaluation (Yague et al., 2014; Hang et al., 2010). Each enterprise could have its own defined approach to consider whether an idea or innovation worth pursuing or not. During their assessment, enterprises could experience barriers that they are facing while applying their assessment procedure. Among these enterprises, there are start-up companies which have the need for special attention for managing the resources. To be able to meet their desired market place they are in need to reduce the risk of failure before development of an innovation.

The result would verify the validity of the assumption. It would be also compared with the similar research. The result would show the similarities and differences about challenges that enterprises involve. At last the real needs and

requirements in assessment processes would be identified to be fulfilled. Fulfilling the weaknesses on current processes would increase the value of innovation outcome in IT start-ups.

III. METHODOLOGY

Our guiding research question is open-ended and would explore the innovation assessment challenges in software development projects within IT start-ups. Since the case for our study is explorative, the research followed by qualitative approach and used in-depth interviews to gather data from a selected group of participants (Creswell, 2009; Gruber & Henkel 2004). This approach would allow the author in-depth understanding of the topic.

The following sections describe the approach which has been followed for conducting this research:

A. Research Setting

For conducting this research, author contacted a target group of start-up companies within the software industry in Nordic countries and Middle East. The aim was to select participants for evaluating the ability of their enterprises on innovation assessment and exploring the challenges that they are facing during their innovation assessment process. From the contacted companies, four start-ups agreed to work with this research. Due to time frame of the thesis, this research finally conducted in collaboration with four participants from different start-ups in Gothenburg and Shiraz under supervision of Gothenburg University. The following table is showing the participants demography.

TABLE I. PARTICIPANTS DEMOGRAPHY

#Person	Total Years of Experience	Age	Type of Company	Start-up establishment year
1	3	25	Enterprise software application development	2011
2	4	25	ICT Operator	2011
3	3	24	Application development	2012
4	5	30	Web application development	2011

The participant selection in this research was "volunteer basis" (Creswell, 2009, p.155). Volunteered participants were four experienced individuals in different positions (CEO, Co-founder, Developer and Project Manager) in four different enterprises. The reason behind the selection was to have a group of individuals with different opinions and experiences that they had based on their position in the companies. Since participants were volunteered entrepreneurs, the chance of having more reliable data increased. The main reason behind this theory is because volunteer entrepreneurs are willing to

participate in research process and share their experiences to be aware of the outcome of this research. Participants were also being independent from each other to not affect the result. Participants had also key position in each enterprise. They were Co-founders and/or Chief Executive Officer (CEO) of the company. This means participants had key role in making decision in the start-ups. Hence their role makes them aware of the issues and challenges during assessment processes of their prospective products.

A. Data Collection

The research question (RQ) and research approach are used to decide on how many interviewees required. Therefore there are four young entrepreneurs with the average of around four years experiences in the IT market.

The designed methodology for addressing the RQ is to use semi-structured in-depth interviews to gather data directly from selected participants. In order to set up the interviews, the author used audio recorded basis to get transcript of the data later.

A questionnaire has been created to be asked from participants in a face-to-face meeting in Sweden or via an online conference tool (e.g. Skype) for remote interviews (see Appendix-1). The questionnaire is designed to collect the relevant data regarding participants' experiences on their process of innovation assessments.

In regard to RQ, the participants for interviews were among young entrepreneurs. They had education backgrounds in areas such as IT Management, Software Engineering and Computer Science. They were experienced entrepreneurs in four different start-ups whom were familiar with innovation assessment processes in software projects. Therefore their answers would be beneficial to explore the research question by different ideas with help of gathered data.

B. Data Analysis

Collected data would be analyzed by thematic approach and the result would be discussed to get the conclusion as outcome of this thesis (Creswell, 2009; Gruber & Henkel 2004). For analyzing the gathered data from participants in their interviews, the following steps have been taken:

a) Extracting audio recorded interviews to text

The recorded data has been extracted to transcript text for conducting further steps of analysis.

b) Applying Thematic Analysis

This method is a proper approach to analyze the collected qualitative data in in-depth interviews (Creswell 2009). According to Braun and Clarke (2006) there are several phases in conducting thematic analysis in collected data. These phases begin with re-reading of the textual data. The primary codes would be extracted from re-reading of the texts. Afterwards primary themes could be candidate for finalizing. These themes should have enough patterns in the data to support. Afterwards the candidate themes would be reviewed and named. The report would be extracted based on the named themes.

In this study, as first phase, textual data has been read carefully for identifying codes from each participant. These

codes extracted based on the research question. This means that each code should relate to challenges or difficulties that each of entrepreneurs faced during their involvement with assessment process of innovations. It had been considered carefully that there is difference between issues that entrepreneurs faces in their enterprise management and challenges in innovation assessment process in their software projects.

After finding the codes from all participants, those identified codes which had same area have been categorized together. Each category consists of codes which could have relation to other categories. However their main core and meanings has been considered to put them in each specific category.

These categories have been used to nominate each of the themes (Creswell, 2009). For identifying the proper themes, highlighted codes in categories are reviewed several times. The codes that consist of patterns and could be supported by texts have been used in nominating themes. After validation of themes and naming them, the result report has been extracted.

In result section, themes would be listed in a table. In this research the author used all extracted themes from all participants. This means that according to sample frame size, the author didn't use the majority to priories themes (Creswell, 2009, p.192).

C. Validation

According to Creswell (2009) validity is one of the strengths in a research; Threats to the validity of the outcome could be internal or external (Creswell, 2009). The threats therefore should be considered in "validation procedure" (Creswell, 2009). In this study the validity has been increased in the following mentioned process.

Identified participants were in different enterprises. They had different education background. Entrepreneurs were working in different key positions within their start-ups. These start-up companies located in Sweden and Middle East. Hence these selected participants have independence on bringing their opinions and experiences in the interviews and answers.

In this study, interviews conducted separately to avoid them influencing each other as external factor which can be a threat for result of data (Creswell, 2009). Additionally according to Taylor (1997) to be able to find out errors and having precise data, it is required to have more than one participant. Therefore the interviews were designed in a way to compare the results by different members in different enterprises. This would show the differences and similarities in results to get more accurate outcome.

In other word, to capture the expectations on challenges facing in innovation assessment from participants and exploring new ideas and also for increasing reliability of the results, different locations and different positions has been selected (Creswell, 2009).

The identified themes also validates by re-reading and going through the codes after nominating the themes for results. Each theme also compared with similar studies to have creditable outcome.

a) Limitation of the study

There were some constraints according to the time frame and structure of this research. The related literature which has been reviewed in thesis design and interviews was delimited according to time frame of the thesis. Therefore the number of questions is not as wide as it could be. Besides due to the time constraints which should fit into the thesis time plan, sample frame was between four start-up companies.

IV. RESULT

In order to investigate challenges of innovation assessment process in start-ups, four young professionals who had started up their businesses between the past three to five years were interviewed. They confirmed RQ assumption that innovation assessment is difficult in their early stage start-ups.

Table II, consists of highlighted themes which have been followed by the definition and expressions from participants for each theme.

TABLE II. HIGHLIHGTED THEMES

#Person	Themes on challenges
	During Innovation Assessment in IT Start-ups
1,2,3,4	A. Resource Constraints
1,3,4	B. Lack of Confidence
2,3,4	C. Scalability Exploration
1,2,3,4	D. Being Inexperienced
1,2,3,4	E. Lack of Proper Process

A. Resource Constraints
- Time

Participants have limited time resources. All of the interviewees stated during assessment process in their innovative idea, one of the important concerns is time constraint. This time constraint is considered in two different dimensions. One of them is regarding available time from participant to put into assessment process as effort hours. On the other hand since these participants mentioned they are facing a dynamic and very competitive market which is shifting very fast; therefore they have time limitation for assessing the idea and developing that into the market. This means that to be able to survive and compete and gain profits, these entrepreneurs need to be able to assess the novel idea, find strengths and weaknesses and focus on the competitive advantage in a limited time frame. Based on the assessment outcome, participants would make decision regarding developing the product. However lack of enough time, make it hard for putting enough effort time on assessment and to find out whether the idea is worth pursuing or not. In light of this, one of the participants stated *"...our time is very limited to define a product which is valuable to the market. We need to put part of our limited time resources to find out about our*

idea validity through assessment of our designed idea which is sometimes not enough ..."

Regarding time constraint, one of the interviewees had earlier experience of failure for his previous start-up project. According to his opinion, this was because of putting insufficient time on assessment process before making decision for further development. This person mentioned *"...sometimes we have this feeling that due to constraint on our available resources such as human resource and budget and lack of enough time, we didn't put sufficient effort on assessment of the idea before making decision on development. This can affect the outcome of the final product significantly... "*

- Capital

Another constraint factor that these young entrepreneurs stated during interviews was that they have very limited capital. This is because start-ups are at the early stage and have very limited market presence. Therefore they cannot change the product easily. For instance some of the participants stated they had to work somewhere else in parallel to their work in start-ups in order to survive and inject capital resources to the company. Participants mentioned that these part-time jobs are required to be able to follow the goal of making their innovation as a prospective commercial product.

This capital constraint had influence on the quality of their efforts on assessment procedure. They stated that budget constraint has direct influence on putting enough attention in assessment process.

In light of this, one of the participants mentioned *"...Sometimes we do the assessment as a primary step without deep consideration. Since we don't have very much capital we cannot put so much effort and capital resource on this step..."*

- Human Resource

The last constraint that they mentioned in this category was human resource. These entrepreneurs are facing constraints in their available human resources for their innovation evaluation. For instance interviewees mentioned there is limitation in having employees involving in start-ups in compare with larger enterprises. Participants also stated they have very delimited number of people in their teams. The most devoted persons were idea owner/s and co-founders. Hence entrepreneurs mentioned they have less available participants for evaluating each idea during their assessment process. This constraint makes it difficult for them to assess all aspects of the idea and considering different opinions in-depth. Hence this is a challenge for them to evaluate whether the idea could meet the desired business goals and customer needs if it develops to a product.

B. Lack of Confidence

Participants were aware of this fact that their start-ups are in an early stage. Since interviewees are operating new start-ups with very limited or no market existence, they have no examples from previous assessments. This means they have no

sample to compare with extracted outcome to measure their chance of being successful.

According to this, participant mentioned they have lack of confidence on their assessment result and their selected process.

These young entrepreneurs have stated they are working with novel ideas with no existence in the market. In other word they have limitation on having enough evidence, data or information to measure or evaluate during their innovation assessment. These kinds of uncertainties regarding lack of enough knowledge or background about their novel ideas make them unsure that whether these limitations have serious influence in their assessment result.

Participants mentioned sometimes they have to repeat assessment in several iterations due to this lack of confidence regarding outcome. Entrepreneurs stated they conducted these iterations because primary outcome gave them this prediction that they might not be successful with their innovation as a product. Such prediction forced them to revise the idea and assess it in several iterations. Participants are not however certain that whether the repeated assessment result is reliable. In other word, participants cannot be sure whether their improvement is enough. This uncertainty even exists in their selected assessment process. Interviewees mentioned they are not sure if they are following right procedure for assessing their idea.

Participants agreed on this fact that such uncertainty and lack of confidence would be a barrier to develop their idea and have affection on motivation of the team for making successful products.

Regarding this challenge one of the participant stated: *"...Making decision according to our assessment is a hard challenge when you have a novel idea which didn't exist before..."*

Other person also specified: *"...when you don't have enough knowledge regarding your idea in terms of previous background or a ready prototype to measure its different aspects during assessment, then you cannot ensure the outcome reliability to trust..."*

C. Scalability Exploration

All of the interviewees stated one of the significant challenges they faced during assessment was in regard to define relevant and proper evaluation metrics for measuring the capability of the innovation. These metrics that they wanted to measure during assessment of the novel innovation could be the basis for finding scalability and growth capability of the prospective idea as a product.

For instance one of the interviewees mentioned *"...as young entrepreneur, we are going to establish our start-up based on our prospective product and it is important to know how far we can go with it?.."*

Entrepreneurs mentioned the core of their start-up is their designed innovative idea. Hence success or failure of their start-up is very depends on the outcome of their idea as a commercial product.

In addition to this, during the interviews, participants mentioned that from the beginning of designing an assessment

process, they need to define proper metrics as evaluation factors. Such factors could give proper innovation profile as outcome. This is important for interviewees to find out real values and shortcomings in their prospective product.

In light of this, one of the entrepreneurs stated they are doing the assessment through questionnaire from volunteers for rating the innovations metrics which has been identified by co-founders. Interviewees were also aware of this fact that they need to improve and update their evaluation metrics continuously to be able to get more reliable result. These metrics should evaluate capability of technology of ideas, their competitive advantages, threats and potentials among competitors.

Participants mentioned that defining proper evaluating metrics which are corresponding to idea's specification is important to them. Evaluation of such metrics could increase understanding of entrepreneurs' estimation about prospective market positioning of their idea. However it is hard for them to assure relevancy and quality of their defined metrics. Therefore they cannot be sure that which position they would achieve and what are the external and internal threats for succeeding of their idea. The lack of gaining such knowledge during the assessment cannot assist them to improve their idea before development.

For instance one of the participants stated *"...market positioning of our innovative idea is depending on how we can compare it with similar products and find out its strength and weaknesses through measuring metrics which are in related to our designed idea ..."*

D. Being Inexperienced

The interviewees were young entrepreneurs. All of these entrepreneurs were agreed that they are inexperienced in compare with other participants in well-established enterprises or senior entrepreneurs. Hence one of the challenges that these young entrepreneurs involve for their assessment is their lack of experience. This could have negative influence on their assessment and making decision regarding their idea.

Interviewees mentioned they need to have some consultant services from senior managers or IT specialists. Such advisors could help them during their assessment procedures. This could cover their gaps on skills and experiences. In other word, this could help them to find real shortcomings in their process and clear a roadmap for optimization and enhancement of their innovation.

According to interviewees' opinion they need to have these experienced participants to be involved in their assessment process. Such experienced advisors would find out the blind spots that these young entrepreneurs could not find during their evaluation. However due to resource constraints, it is not possible for these entrepreneurs to hire consultants. This would be a challenge for them to be able to proceed with assessment of ideas only by their own capabilities and knowledge. This means it is hard for these young entrepreneurs to find out their innovation advantages and disadvantages on their own. Participants mentioned this challenge would slow down the assessment process and affect the reliability of assessment result.

In light of this one person stated *"...It would be great if we could use help of senior managers in our assessment. However the reality is that according to our budget, it is less than possible for us to find a proper consultant..."*

E. Lack of proper process

The participants mentioned they are not following any well-known process or framework for their evaluation and assessment.

According to interviewees' answers about their procedures for innovation assessment, they have to design and use their self-made process. For instance some of participants designed a survey in their start-up to distribute for evaluating defined factors. Another participant specified that they had to re-design a framework based on existing processes in assessment of ideas. They also used similar frameworks in innovation capability evaluation for their process design. Interviewees knew however they have lack of enough skills or knowledge for designing a proper process for their assessment. These participants mentioned they have shortcomings in terms of knowledge about different frameworks for defining right steps and segments. These steps are required for measuring different aspects of innovation and to produce reliable result.

Additionally participants mentioned there is not any customized process to be followed by them. Hence the lack of such a standard process which could be used as a guideline for their assessment caused putting extra and additional efforts and resources by them. Such effort is required for studying similar approaches and defining their own assessment process.

Interviewees stated their company characteristics are different. These participants are working in start-ups which are established based on innovations. Therefore it is making them in higher tension to use standard and well-distributed processes. It could help them to find real weaknesses and strengths in their ideas to be able to overcome market barriers. For instance one of the interviewees stated that *"...We put so much effort to find out how we should design our assessment process. This is because there is not such a customized process available for early stage companies...this effort could be used on assessment itself rather than finding or designing the proper process..."*

V. DISCUSSION

Findings of this research confirm the assumption from our RQ that there are some difficulties in innovation assessment processes within IT start-ups. There are four start-ups in domain of this research for considering the research question. These start-ups worked with different types of innovations in IT industry. They have innovations in enterprise web application projects, ICT products and software application projects. The outcome from interviews shows that start-ups were not an exception from well-established and larger enterprises for the need of having in-depth assessment of their innovations. Such assessment is required for entrepreneurs to affect outcome of their prospective product in a positive way. However the finding of this research highlights this fact that

there are some key challenges existing in their processes that have influence in result of the assessment.

Development of a product which is going to be successful in the market needs an accurate and in-depth assessment. Such assessment could produce a reliable result and product's profile (Hang et al., 2010). To increase the efficiency of processes, it is required to pay attention to the identified challenges that mentioned from participants.

These challenges are in regards to the experiences from the participants in globally spread start-ups. These challenges have their own definitions which have similarities and differentiation from each other. The challenges could be compared with the related researches as well.

The result is categorized in five different themes which some of them are in relation to each other. Those themes are:
- *Resource Constraints*
- *Lack of Confidence*
- *Scalability Exploration*
- *Being Inexperienced*
- *Lack of Proper Process*

The limitation on available resources is one of the highlighted characteristic of the start-ups (Sutton, 2010). For instance, it is mentioned in Hang et al., (2010), that process of innovation assessment in their designed frameworks is a time-consuming procedure. It needs different and wide number of participants. In order to fulfill this requirement, it is required to plan for assigning capital and effort time. Such resources are delimited in companies. Although such constraints existing in all enterprises; however the impact for lacking of them is higher in the start-ups. In other word, when entrepreneurs have limited time and budget they would conduct the assessment with less attention. This means entrepreneurs would make decision in shorter time with less accuracy. This is obvious that the outcome of such assessment has less reliability in compare with larger enterprises.

On the other hand, in Hang et al., (2010), it is mentioned that large enterprises have current customers with their in-market products. These customers would be used as part of assessment of disruptive innovations. The features of each new innovation could be evaluated by a survey. This survey would be distributed among customers. Additional to that, they had also different skilled and experienced employees which could be part of defining assessment framework. Such frameworks are customized for their ideas (Hang et al., 2010). However, resources such as human resource are much more delimited in start-ups. According to result of this study, start-ups have to put more effort time by their limited number of participants to have more accurate result in their assessment. Nevertheless it is very hard for start-ups to manage enough resources for conducting sufficient effort in the assessment. This means that entrepreneurs have less chance of competing with larger enterprises in terms of quality and reliability of their assessment outcome.

These IT start-ups established based on their innovation and these young entrepreneurs need the outcome of their assessment for making the right decision. As it is mentioned in

Gruber and Henkel (2004) entrepreneurs have market entry barriers due to the high competition among software companies. There is massive number of new products in a short period of time from different companies. Therefore it is important for IT start-ups to have innovations which have the chance to grow based on its value proposition. Such values would ensure return of investment. The outcome should help entrepreneurs to understand whether they have a real value with their prospective product for the customer or they need to revise their idea before development. As it mentioned by the participants, for making decision based on the assessment outcome, entrepreneurs should be certain and confident about their result. Well-established enterprises have much more experiences on previous failures and market achievements. Therefore they could evaluate their innovation outcome and make right decision in a short time. The result of this study showed start-ups cannot be as confident as larger enterprises are. They make decision by doing the assessment in several iterations and in higher level of uncertainty and risks.

Some of the challenges identified in findings of this study are the same in all other enterprises about their assessment procedures. For instance there is the need for evaluation of right metrics regarding scalability exploration. In light of this, there are metrics (e.g. Technology, Market positioning, Favorable factors) which defined in Hang et al., (2010). Such metrics have been used in their designed survey as part of their assessment. Answers to these metrics from participant could show the scalability opportunities of the prospective product.

Scalability exploration of the products is based on in-depth understanding of the competitors, weaknesses and strength analysis of the prospective product and having a pragmatic idea which could be developed according to their enterprise resources. Therefore as it mentioned by interviewees in this study, finding relevant metrics for each idea is one of the significant steps of their assessment. Evaluation of each of these mentioned parameters requires formalized process and defined methods which need to be considered carefully in the process.

There are also some identified challenges which are in regards to some specific characters of start-ups such as lack of enough experience among young entrepreneurs. As it mentioned in Sutton (2014) it is difficult to find the relevant process due to have inexperienced participants in start-ups. In other word, uncertainty for outcome of the assessment and managing the resources in an efficient way during the assessment are depending on the level of work experiences from participants.

There are several mentioned approaches in larger companies in this regard. For instance in Hang et al. (2010) managers used help of senior participants with experiences in IT market and in different expertise to find right metrics to evaluate. Therefore they could create a good profile and characteristic map of their innovation. This would facilitate the decision-making in upper layers of management levels.

However as it mentioned by participants, in start-ups, entrepreneurs cannot rely on their assessment outcome. This is mainly because that they have lack of enough experience to

evaluate the outcome reliability. Participants were mentioned that they prefer to involve senior participants during their assessment process. However since they don't have enough resources such as capital to hire senior consultant, it is hard for them to increase the reliability of the assessment outcome in this way. Entrepreneurs in start-ups even don't have sufficient effort time to spend on defining a proper assessment framework. They have also limitation for involving enough participants to validate the result and outcome. The reason for this challenge is that these young entrepreneurs work in parallel and feel in hurry to develop the product as fast as possible. This is because that they need to make revenue as soon as possible.

According to Sutton (2010), since the IT start-ups are in early stage, the role of proper process is really significant in managing their current resources. On the other hand, it is also mentioned in Yague et al., (2014) that even larger enterprises need to define a customize framework for their assessment. This need in start-ups is different. Entrepreneurs in such start-ups would like to define customized process. However they don't have wide and sufficient knowledge about different frameworks in the area of software innovations. This is similar to the findings of the current research regarding the need for having a proper process for assessment of innovations. There is an unhidden fact that these start-ups driven by young creative entrepreneurs. If they could improve their idea before development based on their assessment, then they could increase the chance of developing successful products. On the other hand, if entrepreneurs could have access to a proper process which could be used widely by start-ups in different innovative ideas within the IT field, then it would give the opportunity to increase the strength of the defined framework by feedbacks from these entrepreneurs.

Considering the study result, shows that the research assumption is true. In other word, there are challenges in innovation assessments among IT start-ups. These start-ups are mainly driven by young motivated entrepreneurs. However such challenges make it difficult for them to evaluate their innovation and get the best possible outcome from their ideas.

VI.   FUTURE RESEARCH

There is a possibility to make a survey based on the current result for identified challenges in this study. Such survey could distribute among other start-ups in different locations and with different entrepreneurs to find priority of the challenges.

The findings could also lead to design a customized framework for better development of innovative software projects. Additionally it can help in devising a roadmap for improvement of current assessment procedures in future researches concerned with the innovation evaluation processes.

Additionally, more cases in software development are required to assess by interviews. In creation of the new questionnaire, identified themes could be used as new area for evaluation. These interviews could be conducted on wider range of projects in different IT start-ups. Then the result of

this paper could be evaluated. On the other hand, this research could be followed by considering different solutions for identified weakness points and challenges in innovation assessment of software development projects.

VII.   CONCLUSION

The aim of this study was to find challenges in innovation assessments among IT start-ups. These challenges need to be identified for improvement of assessment processes. For conducting of this research, an evaluation framework has been designed by using in-depth interview method. Questionnaire for evaluation of current processes have extracted and designed with consideration of related literature regarding software innovation assessment processes (e.g. disruptive innovation assessment process).

Data collection process has been conducted by face-to-face interviews which applied to four different start-ups within different projects. This could highlight the challenges during current processes which entrepreneurs were using for their innovations.

Qualitative data which collected from interviews in meetings analyzed to identify the challenges. Analysis of the data has been conducted by using of thematic analysis. After analyzing the data, findings showed five different themes which have been highlighted as difficulties and challenges that participants faced for assessment of their ideas.   The result showed that characteristics of start-ups have direct relation to the process of innovation assessment. In other word, it confirmed that resource limitation in start-ups has negative impact on the outcome of their innovation assessment as well as the quality of analysis of their ideas. Such constraints could increase the uncertainty regarding reliability of the result. Hence these young entrepreneurs cannot make decision easily about going further with their ideas. This lack of confidence which existed with them about their outcome would reduce their motivation on development of their ideas. Participants also faced a challenge on designing a process and defining right metrics and factors which can explore different aspects of the idea. Such factors required to find out real strengths and market values of their idea. Considering these factors would show scalability opportunities in their prospective product. The reason for some of these challenges is that these entrepreneurs are young and inexperienced regarding different solutions for assessments and managing their resources. The other reason is lack of a proper framework or customized process regarding innovation assessments for IT start-ups.

Analysis of the findings in this study and comparing them with similar studies, showed that although there are some similar challenges among different type of enterprises for innovation assessment. However some of the identified challenges are unique in start-ups. Those challenges for instance consist of having inexperienced participants, lack of confidence among entrepreneurs and lack of proper assessment process for them. Therefore there is a need to design a customized framework for innovation assessment of software innovations for IT start-ups. Additionally this could

help in devising a roadmap for improvement of current assessment procedures.

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Appendix 1- In-depth Interview Questionnaire

This questionnaire has been created for a thesis with the following research Question:
What are the challenges of innovation assessment process in IT start-ups by young professional? The questions in in-depth interview are designed in qualitative approach to find out the expression of each contributor based on their experiences on practical project development within software industry.

Some general instructions to apply this questionnaire are:

-A key member of the project's development team should use this interview. Example of members/participants includes: the project leader, the project manager, enterprise owner, and co-founder).

-Data which collected from the interviews can be used to create a list of highlighted challenges in innovation assessment processes in selected SW start-ups and improvement proposal for the future research on the concept.

-Questionnaire used during meeting for interview with each specific participant. Interviews have been conducted in face-to-face meeting in Sweden or with an online conference tool (e.g. Skype, Google Hang Out) if the interview conducted remotely.

Section 1-General Questions

1- When has the company been founded?
2- What is the field of the company for working? (e.g. ICT, IT, Software development, Enterprise web application development)
3- What are your experiences and records (e.g. Education, Age, and Previous work experience)?
4- Have you ever been a founder of a company?

Section 2-Overall measurement Questions

1- How do you assess whether an innovative idea is worth pursuing?
2- How do you investigate the return of investment (cost/effort/resources) for your prospective innovative product?
3- What problems should a framework/tool should cover for innovation assessment and positioning of a novel idea?
4- If there are other challenges that you are facing during assessment of innovations within your start-up, please specify here.