PROPOSED MODEL TO FIND THE GAP BETWEEN ACADEMIC SUPPLY AND INDUSTRY DEMAND IN SOFTWARE ENGINEERING FIELD IN JORDAN

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Abstract: The new trend in software engineering research is how to provide software engineering industry with qualified software engineering graduates; this trend has been appeared because there is an obvious difference between the industry needs and the actual supply from software engineering departments. This paper will introduce briefly software engineering and software development process then it will mention the main properties of software engineering, after that it will represent the changes that happened on the characteristics and expectations of software. A Brief discussion about software engineering graduates and educators will be presented in this paper and the rest of it will discuss a proposed model designed by the researcher to measure the differences between software engineering industry needs and actual supply from software engineering departments.


I. INTRODUCTION

Software development is very different from other types of product development. Software is an intangible product where other engineering disciplines produce tangible products such as buildings and bridges; Software is a relatively new engineering discipline. Because it is intangible, principles used in other engineering disciplines to produce a product free from failure do not apply. No two software development projects are alike [41, 8]. Software engineering is concern about all phases that the development process passes through [35, 36, 37]. The developments process is divided into numbers of processes each process has its main mission and related to number of stakeholders each one of them has his own objectives and interests, the development process of the software system aims to build a system that help in solving real world problems [9, 10]. Since the product is intangible, tracking the building process is an integral portion of software engineering. Unlike the building of a bridge, the production manager cannot look at the product to determine its progress. Software engineering is a methodological process of developing software in a repeatable manner on time within budget such that the software has the following attributes: conforms to specifications, maintainable, dependable, efficient, and usable [40, 38]. There were many changes happened to the software systems in the past causing many challenging in the characteristics and expectations of that systems [1, 3].

II. SOFTWARE ENGINEERING EDUCATION

If we want to define the software engineering education from the point of view of software engineering industry we can define it as follow: teaching the students how to deal with projects in real life and give them enough knowledge about all new techniques and tools that are actually used in SE industry, and to make students able to deal with teams by sharpening their communication and interpersonal skills [2, 4, 12]. This definition considered as the requirements that industry needs from software engineering departments, in other words software engineering graduates must have these requirements in order to enter software engineering industry real life in a smoothly way [11, 14]. That means instructors at universities must take into account when teaching the courses not to teach just the theoretical knowledge, they must allocate number of lectures to cover some topics related to SE industry [16, 17]. This new trend in teaching software engineering will increase the effort needed by the instructors on one hand, on the other hand it will make the students more familiar with software engineering industry real life [15]. One of the main objectives of software engineering education at universities is to produce software engineering graduates who have the ability to deal with real life projects [39], this objective requires a channel that matching the academic institutions with industry, this channel will facilitate the communication between these two parties, in order to make the needed requirement from software engineering graduates more clear to universities [19, 24, 7]. Software engineering departments after that can modify its curriculum upon the needed requirements which they take from the industry. In this research, the researcher will propose a model to help researchers in investigating the actual needs in software engineering.
industry and the actual supply of software engineering departments in Jordan or any other country in order to find the gap between the two parties. The proposed model can be generalized to be applied to any field in education.

III. SOFTWARE ENGINEERING GRADUATES AND EDUCATORS

The fresh graduates of software engineering facing many difficulties at the industry they working in because they find many difference between what they have learned at universities and what they face at the jobs and they find the projects that they deal with is larger than the projects they used to deal with at universities with a different scale also, so it is very important to let the students at their universities to deal with projects that have the same conditions of the actual projects they will deal with in the real life and in software engineering industry [26]. This issue can be done by modifying the syllabus of the projects that the students must complete in the graduation year; this modification for the projects must take in account that the nature of that project must be very similar to the nature of real life projects. The main problem that many of software engineering instructors fall in is that they give projects to students to complete with a certain requirements and specific time, during that time the instructors don’t follow their students in each phase of the software engineering development process, all they do that they just evaluating their students at the end of time of the projects, and the grades they give to students rely on the presentations. This trend that many instructors used doesn’t offer the needed concern about software engineering development process. There are many universities that allow their SE students to train on actual projects in SE industry, sometimes the training takes six months and sometimes up to two years [21,42], this practice in training the students gives them the opportunity to have the experiment of the real project in SE industry that they never face or deal with in their academic life, also this practice will show the students the importance of each phase of software engineering process closely, and let them know the importance of each phase practically [25]. Another trend some universities use for SE students that they allow their students to build systems and software for other students in different departments, this practice can develop and foster the understanding of requirements phase in software engineering process [28, 29]. So it is very important to modify the curriculum in frequent way in order to keep it up to date with the new skills and techniques needed in SE industry. These modifications on the curriculum play a very important role in preparing SE graduates to deal with SE industry in a smoothly way. An important issue we must take into account when modifying the curriculum is the new technologies which are needed by organizations and industry in real life, these new technologies must be added to curriculum by adding some topics to cover these technologies in order to prepare the students with some needed skills and having the ability to deal with in their careers, while sometimes we must discard some topics by removing them from curriculum, but before that we must investigate these topic carefully before removing them especially if they are from introductory topics which affect the foundation knowledge of software engineering [23, 27, 31]. Because of the rapid changes which happened to technologies in software, graduates have new responsibility which is remaining up to date by learning under any condition [20]. To prepare graduates who have the ability to learn requires efforts from educators represented by new methodologies they must use in the teaching process which focus on innovations [25]. There are many new technologies raised which help educators to make the teaching process easier and add many improvements to that process [29]. In addition to the technical skills needed by software engineering industry there are another needed skills which are the communication and interpersonal skills, these skills are very important in team working which the industry rely on in the actual projects in real life [22]. These skills requires more concern from software engineering educators in order to sharpen them, for example pair programming is a new concept of programming relies on team working, this new concept must be deployed by instructors in software engineering education [5, 6]. As we mentioned before software engineering industry relies on team working in actual projects in real life, so one of the factors of the success or failure of any project depends on communication skills [33, 34]. Another important skill needed from software engineering graduates is the leadership; leadership is required in any project, because any team needs a manager who is responsible of assigning responsibilities of team members in order to achieve the mission of the project [32,42]. Regarding to these skills which are needed in software engineering industry, there is a new responsibility of software engineering educators to concentrate on these skills in the education process to sharpen the required skills for software engineering graduates.

IV. REASONS FOR RESTRUCTURING SOFTWARE ENGINEERING EDUCATION

Because of the main differences between the needed knowledge about new techniques and skills from software engineering graduates in software engineering industry and those supplied by software engineering departments, many problems have emerged for each of software engineering graduates, software engineering industry and software engineering departments. The problem which is faced by software engineering graduates is that they
don’t have enough knowledge about the new technology and techniques needed by software engineering industry. And also they don’t have enough communication and interpersonal skills that are also needed by software engineering industry.

On the other hand software engineering industry has difficulties in finding qualified graduates from software engineering departments [29, 30]. This problem happened for the two parties because there was no coordination between them. There must be coordination between software engineering industry and software engineering departments, to let software engineering industry inform software engineering department about the actual needed requirements from SE graduates as a first step, and the second step is implemented by software engineering departments by deploying the needed requirements and skills in the curriculum and the subjects taught to their students, this action will minimize the differences between the actual needs of software engineering industry and the real supply from software engineering departments. On one hand Software engineering industry facing a problem in finding adequate software engineering graduates [13]. On the other hand universities facing a problem in the balancing process between what are needed by industry and what must be taught at software engineering departments [18]. When software engineering departments take the decision of modifying or changing the curriculum, the goal of that changing is to serve both software engineering graduates and software engineering industry [28].

V. STATEMENT OF THE RESEARCH OBJECTIVES

The research purpose is to propose a model to help researchers in investigating the demand which software engineering industry need from university’s software engineering department outcomes (graduates) in Jordan. This phase can be completed using questionnaires and interviews in some software engineering companies. The results of this phase will be then compared with the actual outcomes from university’s software engineering department as the second phase in the study. The results of the two phases will be compared in order to find the gap between them.

VI. THE PROPOSED MODEL TO FIND THE GAP BETWEEN ACADEMIC SUPPLY AND INDUSTRY DEMAND IN SE

Figure 1 represents the proposed model in which there are two main dependence variables which are the SE industry needs, and the SE actual supply from academic institutions. Both variables has number of dimensions, these dimensions for the first variable affect the supply of software engineering departments (graduate students), but according to the second variables these dimensions related to the software engineering industry. If any researcher applies this model in any field of study, he must firstly design number of questions for each dimension then make a study on any population after that collect and analyze the results. After the result analysis the researcher can easily illustrate the gap between academic supply and industry demand in software engineering field (or any other field).

Each dimension the researcher chose has an effect on the variable it’s related to. On other words on one hand the quality of SE graduated students from any university is determined and affected by many variables like University’s capabilities and properties, SE tools and Infrastructure, Scientific research Budget, SE courses, Library Budget, Academic staff capabilities and properties. And on the other hand the quality of needed graduate SE students from SE industry point of view is affected by the following: University’s capabilities and properties, SE tools and Infrastructure, Scientific research Budget, SE courses, Library Budget, Academic staff capabilities and properties, Specific requirement, Specific Skills.
This model will help researchers to find the gap between academic supply and industry demand in software engineering field by applying it to any population they want. The researcher will suggest number of questions according to the proposed model to help researchers using the proposed model. For example if Jordan is the population of the study, and the goal of study is to illustrate the gap between academic supply and industry demand in SE the following question will be suitable:

1. Is there academic supply from software engineering departments according to Industry demand in SE in Jordan?
2. Is there academic supply from software engineering departments according industry demand in SE in Jordan toward SE courses?
3. Is there academic supply from software engineering departments according industry demand in SE in Jordan toward university’s capabilities and properties?
4. Is there academic supply from software engineering departments according industry demand in SE in Jordan toward scientific research budget?
5. Is there academic supply from software engineering departments according industry demand in SE in Jordan toward Library capabilities and budget?
6. Is there academic supply from software engineering departments according industry demand in SE in Jordan toward SE infrastructure and tools?
7. Is there academic supply from software engineering departments according industry demand in SE in Jordan toward academic staff capabilities and properties?
8. Are there specific skills needed from Software engineering department’s graduates for SE Jordanian industry?
9. Are there specific requirement needed from SE department’s graduates for SE Jordanian industry?
10. Is there industry demand from software engineering department’s graduates in SE in Jordan?
11. Is there industry demand from software engineering department’s graduates in SE in Jordan toward SE courses?
12. Is there industry demand from software engineering department’s graduates in SE in Jordan toward university’s capabilities and properties?
13. Is there industry demand from software engineering department’s graduates in SE in Jordan toward scientific research budget?
14. Is there industry demand from software engineering department’s graduates in SE in Jordan toward Library capabilities and budget?
15. Is there industry demand from software engineering department’s graduates in SE in Jordan toward SE infrastructure and tools?
16. Is there industry demand from software engineering department’s graduates in SE in Jordan toward academic staff capabilities and properties?

**CONCLUSION**

In this paper the researcher has presented an overview of software systems and mentioned the features related to that type of systems, and then there was a brief description about software engineering education at universities and an overview about software engineering graduates and educators. After that the researcher mentioned the reasons that forces universities to restructure software engineering education, one of the most important reasons is the differences between the actual academic supply from software engineering departments and the actual need for software engineering industry .Then the researcher proposed a model to find the gap between academic supply and industry demand in software engineering, this model will help researchers to illustrate the gap between academic supply and industry demand in any field, this model will also help researchers in building the new strategies for restructuring SE education in order to narrowing or closing the gap between academic supply and industry demand in SE.

**REFERENCES**


Proposed Model to Find the Gap Between Academic Supply and Industry Demand in Software Engineering

42


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