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Research note

A qualitative investigation of career orientations of a sample of Iranian software engineers

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Abstract This study investigates different types of career orientation of a sample of Iranian software engineers and antecedents of these orientations. A qualitative study was conducted in seven Iranian small to large sized companies, where forty-nine software engineers were interviewed. Using the thematic analysis technique, technical, managerial, entrepreneurial, project based, and hybrid orientations were identified. For some orientations, several sub-orientations were also identified. In addition, the results propose some antecedents of career orientation, mainly based on engineer needs, competencies and values, which may be moderated by some external factors, including organizational and national level phenomena.

1. Introduction

Several researchers have emphasized the importance of identifying employee career orientation in order to customize Human Resource Management (HRM) practices based on the orientations [1–3]. Career orientation has been generally defined as one's career aspiration and preferences in relation to ones self-concept [4]. In other terms, as Derr and Laurent [5] have proposed, the core question for understanding this construct is "What do I want from work; given my perception of who I am and what is possible?" (p. 456). Understanding one's career orientation may help plan one's career path, the design of training and developmental programs, with respect to career orientation, and how one should be treated and led in the organization. For example, Lee and Maurer [3] proposed that project oriented engineers who are attached to specific kinds of projects other than to the profession of engineering or their employer organizations, need special human resource management considerations. Because they may like to build up their careers by working on a series of interesting and challenging projects [2], they must be regularly offered new challenging projects after completion of the old, and be paid for innovation and target completion [3]. Igbaria et al. [4] found that the more compatibility between career orientation and employee job settings, the higher job and career satisfaction, and the stronger the commitment to the organization. These suggest that conducting further research in this area may help researchers and managers better understand how employee satisfaction and performance can be managed [3,6,7]. Understanding engineer career orientations may also be helpful from organizational development perspectives. For example, a company may not be successful in the development of a new department, or in using a new technology that requires the design of new job positions, if its engineers do not possess consistent career orientation.

This paper focuses on software engineer career orientations, considering the importance of the software industry in recent industrial advancement, and the importance of the human resource management of software engineers in software companies [8]. The IEEE Computer Society defines software engineering as: "The application of a systematic, disciplined, quantifiable approach to the development, operation, and maintenance of software; that is, the application of engineering to software." [9]. A software engineer is a professional individual who is actively involved in software engineering and is committed to this profession in terms of practical and ethical aspects [10]. It has been argued that the retention

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of software engineers is arguably related to the extent to which human resource practices are consistent with their career orientation [8]. Although some models of career orientation have been proposed thus far [2–4,6,7], no specific theoretical model has been developed for understanding software engineer career orientation. Lack of an adequate theoretical understanding of software engineer motivation has been recently acknowledged by Beecham and colleagues [8], given some unique characteristics of software engineers and the software industry.

This paper reports the results of a qualitative study that specifically aims to identify software engineer career orientation in Iranian business contexts. It is important to identify Iranian software engineer career orientation, as the growth of software companies may be partly based on managing software engineer career interests and desires. For example, incorporating the service strategy into production based companies [11] may require software engineers with consistent orientation towards maintenance and support activities. This study may be specifically important for HRM in software engineering businesses, because this profession has become more strategic in today's organizations [12], and retention of these engineers may be critical in the competitive labor market of this profession [13,14]. From an Asian management research perspective [15], this study may also contribute to an understanding of software business management in Asian countries, as there may be similar industrial, technological and cultural contextual factors between the software business of some Asian countries and those that exist in an Iranian context.

In the next sections, first, the literature of this area is reviewed and the theoretical framework of the study derived from past literature is presented. Then, the methods and data analysis are explained. Finally, the results are discussed, and some implications of the theoretical framework are proposed for further empirical investigation.

2. Literature review and theoretical framework

2.1. Career orientation and career anchor

Schein [16,17] may be considered one of the premier investigators of employee career interests. He led several studies of employee career interests and preferences in different contexts, such as R&D and academic organizations. Based on his studies, he proposed that employee self-concept in terms of their understanding of their competencies needs motives and basic work values, may contribute to the development of their career decisions in real working environments. He called these 'career anchors', which are formed during one's work experiences. According to his studies, eight career anchors were identified:

1. Technical or functional competence.
2. Managerial competence.
3. Autonomy/independence.
4. Security/stability.
5. A sense of service/dedication.
6. Pure challenge.
7. Life style integration.
8. Entrepreneurial creativity.

Although Schein's work has obviously had a considerable impact on this area, some have argued that the empirical evidence of other researchers has not been completely supportive in regard to Schein's model, and there may be gaps in the theoretical explanation of the relationship between career anchors and job outcome [18].

Some other studies have distinguished career preferences from career anchors, and consider career orientation as preferences. Several types of career orientation have been specifically proposed for engineers, such as technical/professional, managerial and project orientation [2,3,19]. Technical engineers are primarily attached to their professional and technical norms, values and advancement, and, therefore, are more committed to their engineering roles and specialty than they are to a specific project or firm. Managerial-oriented engineers are willing to pursue their career on a managerial ladder in an engineering environment. Project-oriented engineers are more attached to specific kinds of projects that are perceived to be interesting and challenging than specific kinds of organization or the profession of engineering in a specific domain of expertise. Tremblay and colleagues [19] also proposed two other orientations, namely, entrepreneurial and hybrid orientations. Entrepreneurial oriented engineers are willing to start their own business, and hybrid orientation refers to when an engineer may pursue a range of career paths without specific emphasis on a singular career path. We argue that there may be several specialties in technical orientation, and different orientations within managerial or project orientation, because of different types of managerial role and project that can be identified in complex engineering and project-based organizations in the software industry. Therefore, an exploratory research is necessary to identify the sub-orientations of each main orientation of software engineers.

2.2. Development of career orientation

Some studies have been conducted on I.S personnel using Schein's career anchors framework (e.g., [13]). Information Systems (I.S) is broadly defined as a scientific field of study that addresses the range of strategic, managerial and operational activities involved in the gathering, processing, storing, distributing and use of information, and its associated technologies, in society and organizations [20]. In this paper, it is argued that an engineer's career preference may be the outcome of a decision process that relies on, not only internal factors, such as those proposed by Schein, but also on external factors that reinforce or hinder the impact of career anchors on the development of career preference. External factors, such as company size and type, technology life cycle, promotion criteria and compensation system, may impact an engineer's career preference.

To the best knowledge of the authors, very few published papers (e.g., [21,19]) have developed theoretical explanations of how career orientation may be developed, despite considerable efforts by other researchers, such as Schein, in proposing some psychological antecedents. London [21] tried to explain how individual and situational factors can influence one's career motivation. In addition, although Tremblay and colleagues [19] have tried to discuss different types of antecedent (internal and external) of career orientation, it seems that their work needs to be improved by providing a theoretical basis for interpretation of the formation of career orientation [22]. Beecham and colleagues [8] also proposed that both software engineer characteristics and external factors (as moderators) are important for understanding their motivational processes, but they proposed that further research is required to provide a comprehensive theoretical understanding of the phenomenon.

Although Schein proposed career anchors as internal psychological factors as the antecedents of employee career preferences, London [21] and Tremblay and colleagues [19] proposed that external factors also influence the formation of career orientation. London provided a list of individual and situational factors that can influence one's career motivation, and argued that career motivation may be explained as a rational decision making process. Similarly, Tremblay and colleagues [19] proposed that several external factors, such as perceived fairness in rewards, promotion and organizational types, can influence one's career preference, although they did not consider London's work in their theoretical framework. They argued that one may not pursue a career path despite her internal interests because, for example, one may not perceive a fair situation in rewards or promotion systems associated with that career path. In addition, in a high-tech company, there may be more technical/professional engineering opportunities than in low-tech companies and, therefore, engineers who have more interest in technical-based career paths identify more opportunities for technical-oriented paths in high-tech rather than low-tech companies [19].

Consistent with Tremblay and colleagues' propositions, we argue that one may not develop a preference for pursuing a career due to his perception of environmental factors. From this perspective, we distinguish one's career anchor from one's career orientation. The career anchor is defined as one's internal orientation towards a career path due to values, needs and competencies, while career orientation refers to the employee's final preference for pursuing a career path after considering situational factors.

2.3. Using expectancy theory for explaining career orientation development

Given the above arguments and conceptualizations, it seems that the motivation theory of expectancy primarily proposed by Vroom [23,24] may be utilized as the basic theoretical framework for explanation of the development of career orientation, considering both internal [10] and external factors [19]. Vroom's model has been used in several motivational studies in different contexts, such as training motivation and career planning (e.g. [25–27]). According to this theory, in a rational cognitive process, one's motivation to choose an alternative may be the result of a multiplication of three assessments: valence of rewards, probability of achieving the required performance by putting in necessary effort (expectancy), and the probability of gaining rewards by demonstrating the required performance (instrumentality).

Figure 1 demonstrates how the development of an employee's career orientation can be explained using the expectancy theory. From this perspective, career orientation as a motivational phenomenon can be conceptualized, in terms of one's preference for a career path, given one's assessment of internal and external factors that influence the probability of achieving the rewards expected from selecting the career path. One may review one's work values and needs to assess the valence of a given career path. In other words, needs and values may form one's initial interest in a specific career path. Therefore, in the context of this study, valence refers to the extent to which the career path is perceived to be valuable compared to other possible career paths. For example, one may perceive a high valence for managerial orientation because this path satisfies one's need for autonomy, and is consistent with one's value of sense of service to the company or country. Then, the individual may assess his competence in achieving the required performance (for example, some leadership competencies for managerial orientation). Thus, in the context of this study, expectancy refers to the extent to which an engineer perceives a link between the effort put into a specific career path and his/her performance. These assessments may develop a self-concept associated with a specific career path, but one may develop one's actual career orientation after assessment of the probability of environmental factors that facilitate or hinder the achievements of a desirable outcome in that career path. These perceived environmental factors may be related, for example, to organizational strategies, policies and reward and promotion regulations, technology life cycle, fairness and equal opportunities for pursuing career paths feasible in the organization, and organizational types [19]. It is proposed that the career anchor, as an internal psychological phenomenon, may guide one's career path if it is perceived to be feasible in terms of environmental factors. Thus, in the context of this study, instrumentality refers to the extent to which an engineer perceives that his/her performance will lead him/her to gain desirable rewards in a given career path.

It should be acknowledged that using the expectancy theory as the main framework of the study ignores affective phenomena and different limitations of rational decision making into motivational processes, because the main assumption of this theory is rationality [25]. We suggest that future research must also consider affective states and bounded rationality approaches in order to explain the development of career orientation.

From a theoretical perspective, some other work needs and values explored in industrial and organizational psychology [21], in addition to those proposed by Schein [17], may also be incorporated into the theoretical framework, as shown in Figure 1. Different types of need proposed by some classic need-based motivation theories, such as Maslow, Herzberg, and McClelland theories, which have been widely studied, especially in leadership literature [28], may influence the development of career orientation. It can be argued that, for example, one's career orientation may be influenced by the need for achievement, power and affiliation [29], because one may assess the valence of technical orientation in terms of one's need for achievement, and the valence of managerial orientation in terms of one's need for power. Basic needs, proposed by Deci and Ryan [30], may also be incorporated into the framework. According to Deci and Ryan, a need for competence, autonomy and relatedness are basic psychological needs.

In summary, given the theoretical framework of the study, research questions are:

- What kinds of career orientation may be identified for Iranian software engineers?
- What are the antecedents of Iranian software engineer career orientations in terms of internal factors (needs, values and competencies) and external factors (organizational, industrial, societal, etc.)?

3. Research methods

Given the exploratory nature of this study, a qualitative research methodology was used conducting semi-structured interviews. Qualitative studies are rich sources for theory building [31]. The use of qualitative research methods had also been proposed in conducting new lines of research into the human aspect of software engineering [32]. In the beginning of the

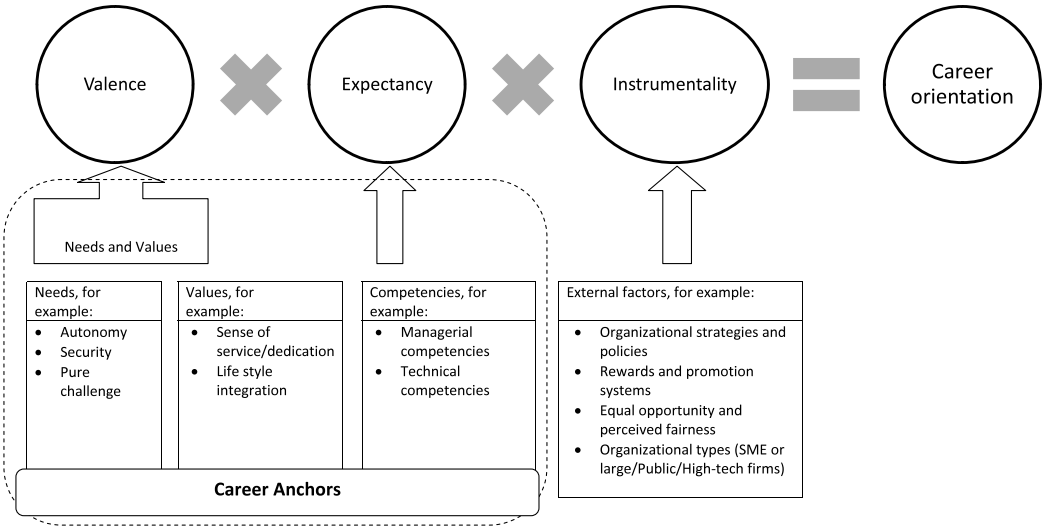

Figure 1: Theoretical framework of the study; using Vroom's expectancy theory to explain the development of career orientation.

Table 1: Sample companies and characteristics of participants.

Type of company	Company no.	Activity	Size*	Number of participants	Edu. level		Mean exp. (yr)	Mean age (yr)	Gender**	
					M.S	B.S			F	M
Software engineering companies	Co1	Software development and services in different areas for private and governmental organizations	Large	17	6	11	10.2	33.2	3	14
	Co2	Software development and services in CRM and CSM for private and governmental organizations	Small	6	–	6	2.6	25.3	3	3
	Co3	Development of software packages for private and governmental insurance companies	Medium	8	–	8	4.4	26.6	5	3
	Co4	Software development and services in different areas for private companies	Small	7	3	4	3.8	26.2	–	7
	Co5	Software development and services in different areas for private companies	Small	2	1	1	9	31	–	2
Non-software engineering companies	Co6	EPC*** construction company	Large	5	2	3	8.4	30.6	2	3
	Co7	R&D company in communication industry	Medium	4	2	2	6.7	29.5	–	4
Total				49	14	35	6.9	29.5	13	36

* Large > 400 employees; 100 employees > Medium > 400 employees; Small < 100 employees.
** F: Female; M: Male.
*** EPC: Engineering, Procurement, Construction.

study, it was decided to select the sample from different types of organization in which software engineers may be identified by different types of job occupation. This includes companies that are actively involved in the software engineering industry, and non-software engineering companies that employ software engineers for their information technology services. It was decided to select companies based on company size, types of activity, and types of ownership (public or private). No database was identified to classify existing Iranian software companies. After contacting some companies in regard to the selection criteria, eventually, seven private companies accepted to support the study. Unfortunately, no public company accepted our request, and this is a limitation of the study which can be explored in future research. Table 1 contains information about participants and their companies. Companies are anonymously named Co1 to Co7. Although there were limitations in collecting data from other types of company, it must be acknowledged that Co1 is probably the largest software engineering company in Iran with both product and service strategies. Therefore, it is expected that various types of career orientation in Iranian companies can be identified in this firm. In addition, Co6 was one of the largest Iranian private construction companies, with country-wide projects, using the latest software and network technologies, and it seems that this company can be considered a valid sample of non-software engineering based Iranian companies. Among the participants, 15 were software project managers or professional managers of their companies, 4 were founders of their businesses, and 30 were programmers, designers, software architects, testers, installers, system supporters, database managers and network administrators. Although

it was possible to interview more participants in these companies, interviewing stopped for final analysis when saturation occurred in our data [33]. This refers to a situation when sufficient data is available to propose an idea in qualitative research, and no new ideas and information can be gathered by continuing to ask previous questions [33].

A general interview guide approach [34] was used. Using this approach, the order or wording of questions can be partly changed, based on the responses. In addition, interviewers can probe new areas and ask follow up questions when important issues come up. At the beginning of each interview, participants were given some broad explanations about the goals of the study and the procedure of interviewing. They were asked whether they agreed to have the interview recorded, and all agreed. Interviews were started with an introductory general question (e.g., 'Please describe the career path you have had from the beginning of your career.') and followed by other general questions about their career interests and the antecedents during their career (e.g., 'What is the desirable image of your career in the future?' and 'Why do you prefer this career path? (if there is a specific answer to the previous question)). The structured interview questions were developed based on the theoretical framework of the study in terms of internal (needs, values and competencies) and external antecedents (e.g., 'What is the impact of environmental factors, such as the characteristics of your organization, which have facilitated or hindered your career objectives?'). At the end, a question was asked to identify any other possible antecedents ('Would you specify any other factors that have influenced your preference for this specific type of career?'). It was expected that the results could expand the original framework.

After each interview, audio recordings were transcribed. The transcriptions were checked and compared to the audio recordings. Then, the transcriptions were carefully reviewed to identify themes, using a theoretical thematic analysis technique [35–37]. In contrast to an inductive approach, this type of qualitative data analysis is driven by the researcher's theoretical position developed at the beginning of the study [35].

4. Data analysis and discussion

Two main sub-sections are reported here. First, different types of career orientation identified in the interviews are discussed, and second, antecedents identified for the career orientations are elaborated. Although quotations could be provided to clarify each theme, only sample key themes are supported by quotations in this paper.

4.1. Types of career orientation

Theme analysis revealed five broad career orientations, namely:

1. Technical.
2. Managerial.
3. Entrepreneurial.
4. Project.
5. Hybrid orientations.

These are consistent with the propositions provided by Tremblay and his colleagues [19] for R&D employees. In addition, several sub-orientations within each career orientation were identified. In the following sections, the results of data analysis for each orientation are discussed.

4.1.1. Technical orientation

Data supports the existence of *technical orientation* and its sub-orientations among software engineers. They preferred constantly advancing their technical expertise and becoming recognized as technical engineers. Given the explanations provided by the interviewees, it seems that of the forty nine interviewees twenty six had different types of technical orientation (see Table 2).

Some preferred working as *programmers*/*implementers* at the initial stage of entering software engineering by developing codes for the development of an application. Although it seems that programming and implementing may consist of two distinct roles, these were integrated into the companies. Some considered *design* and *programming* to be very close occupations. This may be due to the small size of their companies and the extent to which these have been established as legitimate career paths. It was identified that *analysts* usually acted as *testers* of the final software product, given that they had initially defined the system. This situation may differ in other companies, where testing is a separate technical role. *Architecture* was regarded as a prestigious and valuable career path, and many experienced software engineers were inclined to pursue this career path. Some interviewees showed interest in becoming a *technical team leader*. Although the role of team leader has been identified in some international companies [12], it seems that it is not a well-recognized role by many Iranian software engineers. It seems that this is considered a part of the project managers' role, and one engineer believed that this role exists in more advanced companies. Some believed that pursuing this path may not be feasible, due to the lack of such a role in many Iranian companies. This seems to be consistent with the theoretical framework of the study, as the instrumentality has arguably influenced the formation of career orientation. Sub-orientations (o1-8) to (o1-10) were specifically identified among software engineers who were working in non-software engineering companies. Some interviewees expressed their interest in providing *training* services while they were involved in their main job activities.

It was surprising that even in software engineering companies, interviewees showed neither an orientation toward testing nor maintenance, as two important components of the software engineering process. It is possible that the lack of orientation towards testing may partly be due to the lack of established testing processes in these companies (an external factor). A top manager interviewed after the study mentioned that testing in Iran has not yet become a well-established discipline, and it may not be clear to software engineers what this career may produce for them in the future. This problem has also been acknowledged internationally, although some companies have developed some career plans for overcoming this problem [37]. Another possible explanation for the lack of some technical types of career orientation in this study may be related to the evolution and life cycle of this industry in Iran compared with the status of the industry in other countries. We argue that despite major evolution in software technology and engineering processes in advanced international software companies [12], Iranian companies are still undergoing local software engineering development and, also, some advanced technical orientations may not be activated due to limitations caused by the life cycle of the industry in Iran [38]. In addition, lack of maintenance orientation may be related to some technical norms that underestimate the technical value of this career path and consider them second-class occupations [39].

Table 2: Technical sub-orientations.

Career orientation	Sub-orientation	Description
Technical	(o1-1) *Implementation/programming*	Developing codes for the development of an operating system or an application
	(o1-2) *Designing*	Modeling software and the user interface
	(o1-3) *Analyzing*	Understanding customers' needs and transferring it to the specifications of the software that can satisfy the needs
	(o1-4) *Architecture*	Designing of the structure and configuration of software systems in terms of how software is decomposed and organized into its components
	(o1-5) *Team lead*	High level technical advising to a project team and supervising technical issues of a software project
	(o1-6) *Standard and process development*	Development of different types of processes and standards that guarantee the quality of software development and maintenance from the beginning of the project to its closure
	(o1-7) *Database administration*	Development of databases and its management
	(o1-8) *Consultation*	Providing consultation with high level of expertise for management of software systems of companies
	(o1-9) *Network administration*	Maintenance of network efficiency and speed, providing supports for maintaining information on networks, security issues, and resolving users' technical problems
	(o1-10) *Training*	Act as a teacher or trainer of software engineering, especially for teaching programming and software engineering tools and techniques

Low morale, due to lack of recognition and respect, has been identified as a personnel problem in maintenance occupations [39]. Lack of maintenance orientation may be problematic for software companies that pursue a service strategy, as there is a strategy shift, internationally, from products to services, and maintenance is recognized as a key component of the service strategy [11].

4.1.2. Managerial orientation

Some interviewees showed interest and preference in managerial careers. It seems that of the forty nine interviewees, eleven had different types of this orientation. Most engineers with this orientation had sufficient technical experience, and had gradually realized that they were willing to consider managerial, not only technical, careers. Four sub-orientations were identified for this orientation (see Table 3). Although several sub-orientations are related to the managerial aspects of software processes, some showed interest in pursuing non-technical *managerial careers at the middle or top levels* of their organizations, such as human resource management or vice-presidency.

4.1.3. Project orientation

During data analysis, four software engineers were identified who were, or had been, interested in playing various roles in different projects across different organizations. They were not committed to be full-time employees of a specific organization. This was called *project orientation.* It seems that this is consistent with the definition proposed by Allan and Katz [2] for project-oriented engineers. No sub-orientations were identified.

4.1.4. Entrepreneurial orientation

Of the forty nine interviewees, six software engineers were identified who were interested to (o4-1) *start their own business as an independent company* or (o4-2) *start a new company as a branch or division of the main company* that they were working for at the time of the interview. These two orientations were identified as two sub-orientations of *entrepreneurial orientation.* The second sub-orientation may be consistent with some software companies' strategies in outsourcing some technical activities to small companies. This will provide opportunities for starting new companies as divisions of the main company.

4.1.5. Hybrid orientation

Of the forty nine interviewees, some interviewees expressed their interest in a hybrid orientation, when at least two orientations are combined. Twelve interviewees mentioned that their main career interest is to occupy a position with both *technical and managerial* (o5-1) tasks. For example, an engineer with managerial interests expressed:

"I must say that managerial tasks are not the only things of interest to me…I like to be involved in technical activities as well. I like to do the most complex parts of team tasks in such a way that my team members believe in me in terms of technical issues as well…but, this is not the only reason. The main reason is that performing technical tasks is satisfying for me".

Another interviewee described an orientation that seems to be a combination of *technical, entrepreneurial, and managerial orientations* (o5-2). It seems that some new hybrid roles, identified in advanced software companies, are not recognized or considered by interviewees when answering questions about their career orientations. According to Cusumano [12], software businesses have a life cycle, generating various technical and business roles. Today, software companies present a bundle of technical, consulting and maintenance services, so-called a total solution. Some new hybrid roles may be critical in new forms of software business, such as system integrator companies and application service providers (ASP) [40].

4.2. Antecedents of career orientations

In this section, antecedents of different types of career orientation described in the previous section are explained, in terms of need, value and competency as internal factors, and some external factors that can influence the formation of career

Table 3: Managerial sub-orientations.

Managerial	(o2-1) *Project management*	Management of software development projects
	(o2-2) *Product line management*	Management of a group of specific type of projects
	(02-3) *Technical unit management*	Management of a technical department on software engineering
	(o2-4) *Organizational middle and top management*	Management of an organizational department or the whole organization

orientation. Table 4 contains all need, value, competency and external factors identified as the antecedents of each type of orientation. These are described in the following sections.

4.2.1. Antecedents of technical orientation

Several antecedents were identified for technical orientation. First, different kinds of need are acknowledged. It seems that most software engineers with technical orientation were highly interested to *apply their technical knowledge* (n1-1) to real practical experiences. Similarly, some acknowledged a *need to use their creativity* (n1-2) in practice. *Need for social learning* (n1-3), especially from those with more technical experience, was also identified. Some also emphasized that they need to improve their *learning in a dynamic environment* (n1-4), and expressed their dislike of repetitive tasks that do not encompass learning. These seem consistent with the characteristics of knowledge workers identified in previous studies [41]. It is possible that for those with technical orientation, who are mostly at the early stages of their career, acquiring more practical experience and applying the knowledge learned from their student years are important needs. Beecham and colleagues [8] reported similar results, that growth and the learning of new skills have been the most cited characteristics of software engineers in past literature. It was also identified that some preferred technical orientation, because they needed *to have tangible results* (n1-5) and enjoyed observing their technical successes.

The transcripts were also reviewed for values. Only one value was identified, namely; *being marketable* (v1-1), which was proposed frequently. This refers to a value of learning unique techniques instead of simple tasks, in order to stay marketable, in case one may be fired or leave the company. This is consistent with the results of some other studies [41,42] suggesting that being marketable is of key value for knowledge workers.

Several competencies were also identified as antecedents. It was emphasized by several interviewees that one may choose technical orientation if he perceives himself able to maintain being *technically updated* (c1-1) because of the rapidly growing nature of the discipline of software engineering. Therefore, a technical oriented software engineer must be competent and a hard worker in learning new techniques. *Problem solving* (c1-2) was emphasized as another competency, especially for programming and analyzing. It was proposed that the development of arithmetic algorithms and software development needs high levels of problem solving competency. *Concentration and precisions* (c1-3) were proposed as competencies that are essential for technical orientation, especially for programming. Having *domain-specific knowledge* (c1-4) was proposed as an important competency for technical oriented engineers. For example, when one works on finance and administration software solution teams, especially as an analyst, one must have some knowledge of finance and organizational processes. Although *human relation competencies* (c1-5) are important for any organizational interaction, it was emphasized that these are essential for pursuing analytical and network administration career paths in software companies. Given that these careers require considerable social interaction with customers, other technical engineers and users, a lack of this competency may impact one's decision for entering this kind of career. *System thinking* (c1-6) was also proposed as an important competency, especially for analysts, in order to see the big picture of the product, a connection between different parts of the software, and to help customers identify other requirements that they may be unable to recognize themselves. One of the interviewees emphasized that to become an architect, one must possess competency in *understanding the economical consequences of one's decisions* (c1-7), as it is required to pay attention to costs as well as time and quality.

In non-software companies with computer networks, software engineers expressed that one must be *competent in hardware issues* (c1-8) in order to continue this career path. In addition, as mentioned earlier, being competent in *human relations* was emphasized, as user problems must be understood and addressed. It was also emphasized that *stress management* (c1-9) is an important competency of network administrators, as the failures of networks, and loosing information, can be strong sources of stress. For those who were identified with consultation orientation, *organizational knowledge and understanding organizational phenomena* (c1-10) were proposed as important competencies. It was proposed that software engineers who are willing to pursue consultation careers must have sufficient business knowledge and have sufficient work experience with different types of organization. Competencies can be classified into two categories: First, some competencies that can be generally used to explain the formation of all technical sub-orientations (c1-1 to c1-4) and, second, some specific competencies that were proposed as essential for forming a specific type of technical orientation (for example, c1-5 to c1-11).

Several situational variables were identified that may influence the formation of technical orientation. The n*ature of tasks* (s1-1) was emphasized, especially in terms of the extent to which it required learning new techniques. If the task is perceived to be repetitive, it is likely that software engineers with a need for dynamic learning activities will find opportunities for pursuing technical careers in their companies. *Existence of a technical ladder of promotion* (s1-2) is also proposed as an important situational factor, as without an opportunity for promotion in technical careers, one may change one's career path, despite technical career anchors. Similarly, a *compensation system* (s1-3) was also proposed as a factor that can discourage a technical engineer to continue this career. In some companies, in order to increase salaries and incentives,

Table 4: Antecedents of technical career orientation.

Needs	Values	Competencies	External factors
Antecedents of technical career orientation			
(n1-1) Need for applying technical knowledge;	(v1-1) Being marketable.	(c1-1) Updating knowledge and learning capability;	(s1-1) Type of tasks;
(n1-2) Need for activate creativity;		(c1-2) Problem-solving;	(s1-2) Existence of technical ladders of promotion;
(n1-3) Need for social learning;		(c1-3) Concentration and precision;	(s1-3) Compensation system;
(n1-4) Need for dynamic learning;		(c1-4) Domain-specific knowledge;	(s1-4) Learning culture;
(n1-5) Need for having objective results.		(c1-5) Human relations (for analyzing orientation);	(s1-5) Type of company;
		(c1-6) System thinking (for analyzing orientation);	(s1-6) Company size;
		(c1-7) Economical assessment (for architecture orientation);	(s1-7) Company strategy;
		(c1-8) Hardware competencies (for network technical orientation);	(s1-8) Status and maturity of software engineering in Iran.
			(c1-9) Stress management (for network administration orientation);
		(c1-10) Organizational knowledge (for consulting orientation).	
Antecedents of managerial career orientation			
(n2-1) Need for independence;	(v2-1) Job scope;	(c2-1) Leadership;	(s2-1) Managerial career paths as the only ways of promotion:
(n2-2) Need for relatedness;	(v2-2) Challenge;	(c2-2) Organizational knowledge and maturity;	(s2-2) Organization circumstances;
(n2-3) Need for power;	(v2-3) Addressing more complex and important issues;	(c2-3) Risk taking;	(s2-3) Technical level of software engineering in Iranian companies.
(n2-4) Need for promotion;	(v2-4) Helping others;	(c2-4) Technical competencies (for project management orientation);	
(n2-5) Need for income;	(v2-5) Fairness;	(c2-5) Project management competencies (for project management orientation).	
(n2-6) Need for security.	(v2-6) Having a considerable impact on the country.		
Antecedents of entrepreneurial career orientation			
(n4-1) Need for high achievement;	(v4-1) Working in a professional working environment.	(c4-1) Creativity and innovation;	(s4-1) Working in a company where new ideas are not appreciated.
(n4-2) Need for new experiences;		(c4-2) Leadership;	
(n4-3) Need for high level of independence.		(c4-3) Long-term orientation;	
		(c4-4) Hardiness.	

the only way is to choose the managerial career path, despite having technical career anchors. Existence of a *learning culture* (s1-4) may be another situational factor. Some may not be able to continue their technical careers when their companies do not support learning in technical aspects. However, a technical oriented engineer mentioned that he had been able to continue his technical path, because the company provided considerable technical training opportunities for technical employees. *Type of company* (s1-5), in terms of being private or governmental, was also proposed as an important motivational factor by those with experience in governmental organizations. Some mentioned that pursuing technical careers is more feasible in private companies. Some interviewees proposed *company size* (s1-6) as an important situational factor. They perceived large software companies as more appropriate contexts for pursuing technical careers, given the existence of larger projects and more experienced technical engineers in these companies, compared with small companies. *Organizational strategy* (s1-7) may also be a situational factor. An engineer may eventually prefer to choose a different path from his/her initial technical preference in order to support the organization in managerial positions.

In addition to organizational level phenomena as environmental factors, some emphasized that the *status and maturity of software engineering in Iran* (s1-8) is also an environmental factor at the national level that influences the formation of technical orientation. Some proposed that software engineering in Iran is a relatively new discipline, compared to other engineering disciplines and, therefore, software engineers in Iran are more generalists than specialists in a specific area, due to the nature of projects and the young labor market of software engineering. Iranian software companies do not invest sufficiently in technological innovation and may normally acquire needed technologies from external sources. Furthermore, in these companies, technology migration may not happen incrementally,

but discontinuously. In other words, Iranian software companies may try to exploit technologies, without any significant improvement, till previous technologies are substituted by new and emergent ones. Switching to new technologies (e.g. from Delphi to.NET Technology) requires new knowledge and expertise. Therefore, a group of software engineers whose competencies are related to old technology may not have sufficient time for acquiring new knowledge. Thus, they may prefer to be generalists rather than specialists, because this strategy may minimize the cost of adaptation to new technologies, and may allow them to keep their positions, even when a radical technological change has occurred. This argument requires more research and evidence for future research.

4.2.2. Antecedents of managerial orientation

Data analysis revealed several antecedents for managerial orientation, in terms of need, value, competency, and environmental factors. Different needs were identified as the general antecedents of managerial orientation. Several interviewees with managerial orientation expressed that managerial careers can satisfy their *need for independence* (n2-1), and this kind of career can give them sufficient authority to choose the way they wish to perform their tasks. This seems to be consistent with the results of previous research on software engineer characteristics [8]. Software engineers with managerial career orientation may possess a strong *need for relatedness* (n2-2), which can be satisfied when they accept managerial roles. In addition, some described their need to relatedness as an opportunity to help and guide others. A n*eed for power* (n2-3) was also identified as an antecedent of managerial orientation. Some mentioned that occupation of managerial positions can satisfy this need. Some expressed this as a personal need, while some described it as a vehicle to gain more job authority for making organizational decisions. The above ideas seem to be consistent with McClelland's theory [29] to suggest the need for power as an important motivational factor of managers.

It was identified that managerial orientation was perceived to be the only strategy for some interviewees to satisfy their *need for promotion* (n2-4), because they cannot identify any other way for promotion when no technical promotion is available, given the level of software engineering technology in their companies. This seems consistent with the theoretical framework of the study, as the existence of higher levels of technical role can moderate the impact of career anchors on technical career orientation. In addition, the low probability of pursuing technical career paths may increase the possibility of choosing managerial paths when promotion is perceived to be a strong need.

Need for income (n2-5) was also identified as a possible antecedent of managerial career orientation. It seems that the lack of high level technical positions with sufficient income has encouraged some engineers to choose managerial orientation. *Need for security* (n2-6) was also identified. Some preferred managerial career because they believed that it may give them more job security than other career paths.

Transcripts were also analyzed in terms of antecedents of managerial career orientation, in terms of value. For some interviewees, being involved in activities with a *large scope* (v2-1) was an important value. For example, for an engineer with project management orientation, a large project was more important, because he perceived that being responsible for large projects will make him more significant. Being involved in *challenging jobs* (v2-2) was also an important value for some interviewees with managerial orientations. Another value identified was to *address more complex and important issues* (v2-3), which encourages some engineers to pursue managerial careers after some years of technical experience.

Another interviewee mentioned that although managerial activities are critical for the success of a software company, some software engineers may not value these activities, while they may identify technical issues as having more value. Therefore, an important consideration for starting a managerial career is to value the importance of management. *Helping others* (v2-4), including subordinates or customers, was an important value for some managerial oriented engineers. Especially, some emphasized serving customers and solving their problems as an important value. Some, with managerial orientation, emphasized that creating a *fair* (v2-5) organization is a very important value for them, which has encouraged their orientation towards management. *Having a considerable impact on the country* (v2-6) may have been an important value affecting some engineers' preferences for choosing managerial career paths. This may be consistent with Schein's anchor of a sense of service [16].

Competencies perceived to be essential for managerial orientation were also identified in interviews. Although several competencies were proposed, it was emphasized that *job experience* is an important antecedent of managerial orientation, and many of the proposed competencies are actually developed during job experience, and, therefore, managerial career orientation is more likely to be activated after some years. This is, theoretically and methodologically, important for further research. In addition, this must be statistically controlled in future quantitative research when studying the impact of personal competency on career orientation.

According to some respondents, the extent to which a software engineer perceives himself/herself to be capable of *leadership* (c2-1), containing competencies, such as *motivating others*, *accepting responsibility*, *building trust*, *making effective decisions,* and *delegating,* influences his/her management career orientation. Some described their interest in managerial orientation because they believed that they were *mature* and capable of performing important managerial tasks, due to their *organizational knowledge* (c2-2). Two interviewees described *risk taking* (c2-3) as an important competency for managerial career paths.

Some competencies were specifically identified for some sub-orientations. *Technical competency* (c2-4) was described as an important competency for pursuing project management orientation by some interviewees. One mentioned that technical competency is critical, in order to understand technical issues of project team members. This was emphasized as an important factor of building trust in the project manager. One may not choose a project management path if one does not perceive oneself as possessing sufficient technical competency. In order to choose project management paths, it was emphasized that *project management competency* (c2-5), such as time management, influences the decision.

Some external factors were identified that could influence management career orientation. In some organizations, *managerial career paths as the only way towards promotion* (s2-1) was identified as an important external factor. Some emphasized that because of their organizational commitments, they preferred to select managerial positions, due to *the circumstances of their organizations* (s2-2) and the necessity of serving their companies; another external factor that was related to some interviewees' perceptions of the *technical level of software*

engineering in Iranian companies (s2-3). Some may select a managerial career path after some years of technical experience, because they may perceive the technical level of the industry as a barrier to technical promotion. This may also be related to the oligopoly of software companies in Iran, resulting in limited technological positions. These companies seem not to be in competition with international brands, possibly because of political sanctions and limitations. Therefore, they may not need to invest considerably in technologies, but some incremental improvements may be normally implemented to adapt current products and/or services to customers' new requirements.

4.2.3. Antecedents of project orientation

Few antecedents were identified for project orientation. As mentioned earlier, software engineers with project orientation are likely to work in different projects for different organizations, and have no commitment to a specific company. Some interviewees with project orientation expressed that *they need to earn money in a short time* (n3-1), and being project oriented can satisfy this need, despite the fact that sometimes they may not be able to identify new work opportunities for some time. One mentioned that the risk of not identifying a new project is a barrier that made him change his project oriented career, because of his need to have a stable career after some years. From this perspective, it is proposed that project orientation may be developed for a software engineer if he/she *does not need a stable career* (n3-2). Two interviewees with project orientation believed that working in different projects for different companies provided them with various types of technical and managerial experience, and this keeps them *updated with different types of software technology* (n3-3) that may not be acquired by working in only one company. Some interviewees also expressed that being project oriented satisfied their *need for independency* (n3-4), as they preferred not being dependent on a specific company. Although the above four needs were identified, no specific values and competency were discovered as antecedents of project orientation.

4.2.4. Antecedents of entrepreneurial orientation

Three main needs proposed for entrepreneurial orientation were (n4-1) *need for high achievement,* (n4-2) *need for new experiences*, and (n4-3) *need for high level of independence.* The first two values were acknowledged by interviewees to describe entrepreneurs, while the third need was proposed by some software engineers who perceived themselves as entrepreneurial-orientated engineers. Some interviewees who expressed themselves as being entrepreneurial described themselves as individuals who were interested in working more independently, not as a subordinate. These results seem to be consistent with previous studies of the psychological characteristics of entrepreneurs, in terms of having a need for autonomy, achievement and innovativeness [43].

Only one value was identified in the interview transcripts as the antecedent of entrepreneurial orientation. *Working in a professional working environment* (v4-1), the value of which, rather than only business and financial objectives, was emphasized by some interviewees with entrepreneurial orientation as a work value.

Several competencies were identified as possible antecedents of entrepreneurial orientation. It was emphasized that a software engineer may be inclined toward entrepreneurship when he/she perceives himself/herself to be creative in regard to business ideas and able to develop innovative thoughts, in order to transform his creative ideas into tangible business results, that is, *Creativity and innovation* (c4-1). It was also suggested that entrepreneurial career paths require *leadership* (c4-2) competency. One may not pursue an entrepreneurial career path if one does not perceive oneself able to lead other people and create motives for working in difficult situations. According to the interviewees with entrepreneurial orientation, they perceive themselves as being competent in predicting the future and in having *long-term orientation* (c4-3) of their business. Some interviewees believed that pursuing an entrepreneurial career path requires considerable *hardiness* (c4-4), given the numerous difficulties and challenges that may be faced during entrepreneurial processes.

It was identified that *working in a company where new ideas are not appreciated* (s4-1) was the main external factor possibly having a considerable impact on the development of entrepreneurial orientation. Most interviewees with entrepreneurial orientation believed that they needed to start new businesses, because their current or previous companies did not allow them to develop new ideas. One possible explanation is that the innovative context of the software industry enhances the innovative culture of software companies.

4.3. Using expectancy theory for interpretation of data

As proposed in the theoretical framework, the expectancy theory may provide some interpretations for the developmental process of career orientation (see Figure 1). Given the needs, values, and competencies identified in this study for each type of career orientation, it can be argued that values and needs are important in the formation of the valence component of the framework. Some results support this proposition. For example, an interviewee mentioned that his need for security and stability have influenced his career orientation.

"I personally like technical roles very much. The first reason is that I really enjoy performing technical activities, especially programming. But, another reason is that, if one can master technical issues, there is more job security and stability. We are basically developing software solutions, and there are always positions for top technical engineers…if there is no managerial position, you can become an architect".

It seems that perceived competencies play an important role in the formation of the expectancy component of the model, as proposed in the theoretical framework. Some evidence supports this proposition. For example, an interviewee mentioned that.

"I suppose I can be successful in any role, because I believe in myself. But, I suppose I am more successful in managerial roles because of my practical experience. Another fact is that new software engineers are sharper than us in technical issues and, therefore, I may not be able to compete with them in technical issues, but my experience helps me become successful in managerial positions".

In this case, the interviewee's assessment of his/her technical, compared with his/her managerial, competencies has affected his/her career orientation. This seems to be consistent with the self-efficacy construct and its impact on the career development process proposed by Bandura [44], which has been widely incorporated into the expectancy theory in past research [45]. Supporting the impact of values and need on the valence component described earlier, this participant also emphasized that, in addition to his/her assessment of managerial competencies, he/she liked managerial roles because of his/her need for power and social status. External factors arguably impact the instrumentality component of the

framework. These external factors moderate the impact of career anchors on career orientation. For example, a participant expressed that.

"I believe that everyone here initially likes only technical roles. But, when you realize that your income can be higher when you pursue managerial roles, you may change your career path…Another problem is that some technical roles have not yet been established in our company and, therefore, you have no choice except managerial roles".

In this example, it seems that the compensation system and the available technical ladders are external factors that may change one's orientation from technical to managerial.

In summary, it seems that the expectancy theory can provide some interpretation in understanding the qualitative data, although no evidence was identified consistent with the idea of bounded rationality [46].

5. Conclusions

As mentioned earlier, the main goal of this study was to identify different types of career orientation of software engineers in Iranian business contexts, and the antecedents of the orientation. A qualitative study was conducted using semi-structured interviews with 49 software engineers working in different types of Iranian company. The results suggest that five career orientations, namely; technical, managerial, project, entrepreneurial, and hybrid orientations, may exist. Each orientation consists of different sub-orientations. An important finding of this study was that some important technical orientations, such as test and maintenance orientations, were not expressed in this study. This is critical for companies that have selected a service strategy as well as production, given the critical role of these orientations for currently growing software companies. It is recommended to develop human resources practices that can develop and boost these key orientations. The main methodological limitation of this study is that some other orientations may be identified in other industries and companies with other characteristics. It must be emphasized that the companies were among well-recognized and countrywide organizations, which are likely to possess most software engineering occupations available in Iranian business contexts. It is also possible that some other orientations may be identified in other countries with different characteristics in their software engineering industries.

It seems that the results of this study can be interpreted by the theoretical framework of the study (Figure 1). As mentioned earlier, an important proposition of this article is to provide a theoretical framework, based on Vroom's expectancy theory, integrating both the internal and external factors that influence one's career orientation. According to this framework, an engineer's values, need, and competency specify his/her career anchor, as internal factors, and external factors moderate the influence of his/her career anchors on career orientation.

The results of the study suggest that there may be different causes for different types of career orientation. While technically oriented software engineers may need to continuously improve their technical competencies and emphasize their values for being marketable, those with managerial orientation may emphasize their need for power and achievement, and value performing managerial tasks with high levels of human relations, with a great sense of service to their company or country. Therefore, the outcome of the study can be models of antecedents of different types of career orientation, based on career anchors and external factors proposed in Table 4.

Future research must use quantitative methodology in order to test the theoretical framework of the study for each type of career orientation, considering the results reported in Table 4, as the antecedents. Another suggestion for future research is to conduct studies about the antecedents of specific sub-orientations, such as testing and maintenance, which have not been identified in this study. This is specifically important, as some software companies may have difficulty encouraging their engineers to pursue these careers as essentials roles in software engineering processes [37,39]. The results of this study may also have some contributions to the latest theoretical understanding of software engineers' motivational processes [8], in terms of their orientation towards their careers. The main theoretical limitation is the assumption of rationality. The bounded rationality perspective [46] must be explored in future research.

The results of this study may help software engineering companies better understand the characteristics of their software engineers with different types of orientation. This may help them select appropriate leadership styles consistent with their employees' values, needs, and competencies, and develop effective career plans, which can provide their companies with capable and motivated software engineers. For example, providing technically oriented engineers with continuous technical training, and hiring technical coaches with high levels of expertise, may encourage young software engineers to remain in technical career paths, as these actions may satisfy their need for social learning in a dynamic environment, and to value the importance of being marketable. Understanding software engineer career anchors can help companies develop organizational rules and HRM systems in ways that encourage engineers to pursue career paths that improve engineer job satisfaction and commitment and support organizational strategies. For example, it is necessary to identify how a company can encourage its software engineers to pursue testing career paths, if the strategy is to improve the quality of the system by development of the test function in the company. In addition, a company may need to implement the dual or multiple-ladder approach into its compensation system, in order to encourage technical promotion [42]. Development of career plans can encourage the development of some career orientations, such as testing [37]. Software companies in countries like Iran should also take into account the influence of macro environment factors on their software engineers' career orientation, such as the IT industry life cycle of the country.

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