

# NON-TECHNICAL COMPETENCIES REQUIRED FOR INFORMATION TECHNOLOGY PROFESSIONALS: HOW TO EFFECTIVELY INTERACT WITH CLIENTS/USERS

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*After considering reasons for developing the competencies of information technology (IT) professionals, some of their key non-technical competencies are identified and discussed. Focusing on competence in their communicative interactions, results are presented from a survey which was performed to identify specific components of competence in interaction with clients/users. A total of 150 traits was evaluated by 424 IT professionals. Four factors have been found to contribute to competence in interaction with clients/users: (1) work effectiveness; (2) productive information exchange; (3) agreeableness; and (4) sales related characteristics. Results are interpreted in relation to the demands of the professional environment of IT personnel.*

**Keywords:** information technology, software engineering, personnel, competency, communication skills, college curriculum.

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## 1. INTRODUCTION

Modern organizations are facing the challenge of rapid change in both their external and internal environments. Their structure and information processes have to adapt to increasingly competitive business surroundings, as well as to the unprecedented advancement of information technology (IT). An important way to sustain competitiveness is by adequately implementing the rapidly evolving IT into the business processes of an organization.

Today's *competencies of professionals who implement IT* need to answer the demands imposed by organizational restructuring, accelerating advances in technology, and increased client/user expectancy. Scholars and experts in the field of software engineering and computer science are making efforts to identify the *key competencies* of IT professionals which would enable them to more effectively provide their products and services. Insufficiency of college curricula and organizational training to develop the required competencies need to be overcome to increase the potential for (1) viable software development and implementation process, (2) successful individual and team performance, and (3) improved customer service.

Both *technical* and *social factors* influence the development, acceptance and utilization of IT in organizations. While the pace of IT evolution imposes pressure on acquisition and retention of up-to-date technical competence, changes in the work environment and customer expectation foster advancement in the social competencies of IT professionals. After reflecting on the *non-technical* competencies accentuated by diverse experts and scholars, this paper focuses on presenting the results of empirical research into the competencies needed by IT professionals to effectively interact with users.

## 2. THE TURBULENT ARENA FOR IT PROFESSIONAL PRACTICE

Today's software development is confronted with an ever-increasing environmental complexity together with a common demand to incorporate legacy systems from preceding generations: companies are straining to manage the production and maintenance processes over the multitude of programming and scripting languages, database systems, communications and operating systems, terminal emulations and Web interfaces, relying mostly on their messy and deficiently documented details [13]. Moreover, software developers have to adapt to technology changes seven times faster than do other engineers, to adopt ever newer yet short-lived languages, to build highly complex software under tight schedules and budgets, and at the same time to often be dependent on capricious superiors [16].

Software makes an important contribution to the advancement of the Information age, but it is experiencing a fallback in relation to progress on the hardware side, with trends that indicate the unlikelihood of a substantial increase in programmer productivity [15]. There is still a software crisis since management expectations and customer desires have risen during the last two decades of technological advancement, while at the same time about 60 percent of software projects exceed forecasted program costs and finish behind schedule [4]. In addition, many organizations are discovering that the total cost of investing, operating and maintaining IT systems greatly exceeds its identifiable benefits [24].

In the current environment of corporate restructuring, reengineering, downsizing, and rightsizing, on the one hand, and increased demand for computer technology, on the other hand, there is a composite of other influences which affects the IT work force: the changing mix of skills demanded of IT professionals, the adoption of labor-saving technology, the trend toward IT outsourcing strategies, and the hiring of offshore software vendors [14]. Despite the many problems which characterize the IT profession, there remain good job prospects since the US Bureau of Labor Statistics has projected that more than 600,000 jobs for systems analysts and computer engineers will be added in the US alone between 1994 and 2005<sup>1</sup>. Currently there is an estimated shortage of 300,000 software professionals in the US, and even retired mainframe programmers are re-employed to work on the Year 2000 problem [28].

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<sup>1</sup> Recent trends toward global recession could disrupt previously favorable projections for employment in other world regions.



### 3. THE DEMAND FOR THE ADVANCED COMPETENCY OF IT PROFESSIONALS

We have outlined numerous factors which contribute to the *importance of diverse kinds of competency* in IT professional practice: the pressure for the increased effectiveness of organizations, an upgrade of software complexity in an organizational setting, restructuring and rapid technological change, transformation of work systems, the quantity of the IT work force, and the impact of IT professional practice on the organizational and social environments. More than 25 years ago it was recognized that people are one of the most important factors in software development [27], and today there is still much attention given to the advancement of various competencies of IT professionals due to the high costs and failures associated with IT development and implementation. As an illustration, there are estimates that worldwide expenditure to solve the Year 2000 problem may exceed \$500 billion, and that costs associated with law suits due to non-compliant software could be almost double that amount [28].

Scholars and experts in IT emphasize the importance of attaining up-to-date technical competency, as well as diverse non-technical competencies and skills for successful IT practice [3; 6; 7; 8; 9; 12; 18]. Some of the most commonly emphasized *non-technical* competencies required from IT professionals are related to: (i) problem solving, creativity and innovation; (ii) oral and written communication; (iii) effective cooperation and teamwork; (iv) interpersonal skills; (v) business knowledge/skills; and (vi) ability to continuously re-skill and acquire new knowledge. These competencies are associated with many fields of IT related professional activity:

- (i) Problem solving skills, creativity and innovation contribute to the problem assessment and software design process, as well as to project management and decision making in the software development and implementation processes.
- (ii) Oral and written communication is important in inter-organizational and client-related or user-related communications and presentations, as well as in written correspondence, and in writing manuals and documentation.
- (iii) Effective cooperation and teamwork are necessary to integrate diverse individual competencies and work assignments when complex tasks have to be performed in software design/implementation teams, in group decision making, and particularly in virtual organizations or teams connected by means of videoteleconferencing, groupware, or other kinds of computer-mediated communication.
- (iv) Interpersonal skills (i.e. *social and people skills*) are helpful in developing interpersonal relations, the communication climate, cooperation and trust in organizations, and they can also contribute to sales activities and customer satisfaction with IT implementation and service.
- (v) Business knowledge/skills are necessary for assessment of the economic aspects of IT projects and cost-effectiveness of teams, for management of work groups, for understanding the human resource issues related to IT personnel, as well as for decision making and effective implementation of IT in organizational structures.

- (vi) The ability to continuously re-skill and acquire new knowledge is important for comprehension, adoption and utilization of novel IT, as well as for adaptation to different problem domains and professional environments, especially in relation to the demands imposed by career advancement (i.e. from programmer to manager).

#### 4. A FOCUS ON THE COMMUNICATIVE COMPETENCIES OF IT PROFESSIONALS

An exemplar of communication skills will provide insight into the growing concern in the development and utilization of non-technical competencies of IT professionals. For more than two decades there has existed interest in including communication courses in curricula for students of IT disciplines [10; 2]. However, the early concerns for communication training were narrow and predominantly limited to written communication and oral/presentation skills [5]. Recently, more attention has been given to other areas: interpersonal communication, small group communication and teamwork, intercultural interaction, communicating in group decision making, negotiation, as well as to interviewing, questioning, and other client-related forms of communication [6].

Significant effects of communicative practice and network structure on cooperative software development have been accounted for by theory [19], and confirmed by system dynamics simulations [1], as well as by empirical studies in organizational settings [22]. Finally, it must be noted that computer-mediated communication [25] further expands the demand on the communicative competencies of IT professionals, as for instance in virtual team shift work or 24-hour software development [11].

#### 5. RESEARCH INTO COMPETENCE IN PROFESSIONAL INTERACTION WITH CLIENTS/USERS

Competence can be defined as *adequacy, i.e. possession of the required knowledge, skill, qualification, or capacity*. Numerous studies reviewed by Spitzberg [23] give evidence that a significant proportion of adults lack competence and express incompetent behaviors in their interpersonal interactions with others, i.e. that they have social difficulty and experience functional disability, or even handicap due to social anxiety or lack of social/communicative skills. Furthermore, interpersonal relationships appear to be affected by conflict, communicative aggression, defensiveness, complaints, insults, degradation, guilt, predicaments, hassles, betrayal, regrettable messages, conversational abandonment, and narcissism. Finally, information exchange in relationships is commonly erroneous, with or without the intention of the actors, and is characterized by uncertainty, second-guessing, withholding of information, deliberate miscommunication, deception, suspicion, and topics about which the actors cannot communicate. We can conclude that there is great potential for difficulty, erosion, and even breakdown in *any* interpersonal interaction.

Competence can also be defined as: (1) the *manifested potential of individuals* to satisfy a goal and to perceive that they have satisfied a goal within the limits of a given situation, without jeopardizing their ability or opportunity to pursue other subjectively



or objectively more important goals; as well as (2) the ability to appropriately express *adaptation, control and collaboration* in interaction with other actors (adapted from [20]).

The quality of service delivered is highly dependent on the competencies related to interaction with the clients/users of IT. Preliminary research on this topic [2] revealed potential causes of communicative failure in interaction between IT professionals and users, while further research, presented later in this paper, focused on identifying factors that contribute to the manifestation of competence in those interactions.

### 5.1. Method

The empirical part of this research was performed over a three-year period and consisted of the following phases:

1. More than 300 students of software engineering were asked to list up to 10 traits which contribute to the effective communication of IT professionals with users.
2. A preliminary extensive list with 150 different traits was created from student responses and given for evaluation to 186 IT professionals (rating was carried out on a 1-5 scale in relation to the importance of a trait in communication with clients/users of IT).
3. Ranking by average rating, as well as factor analyses were performed on the evaluation data collected from IT professionals. The *most important* and the *least important* traits, and also different *classes* of traits were identified.
4. In a parallel survey, 195 IT professionals responded to a question in which they were asked to freely select three traits on the basis of their job experience (no list was used this time) which they believed are the most important in relation to communication with users. Ranking of traits collected from their responses was performed on the basis of the frequency with which a specific trait was mentioned.
5. Results of the analyses in phases 3 and 4 were combined to create a final list of 150 different traits (traits with higher rating/frequency, and factor markers as well, were selected from the previous lists of traits to constitute a new list).
6. The final list with 150 traits, which had been proven to be related to communication with users, was evaluated by 424 IT professionals on a 1-5 scale ranging from "especially unimportant" to "especially important" for IT professionals when they communicate with users.
7. Ranking by average rating, as well as factor analysis (principal components method, Varimax rotation), was used to identify the *components of competence in communication with users of IT*.

The 424 subjects in the final phase of our research were predominantly software engineers and programmers, but our sample also included computer scientists, economists, electrical engineers, and other professionals with knowledge of IT, who were engaged in development, service, sales, and educational activities related to IT.

## 5.2. Results

The following traits received *highest average rating* by IT professionals in our sample (we chose to present only a shorter list of traits with average ratings from 4.30 to 4.57, and to list the traits in descending order of their average rating): problem identification, knowledge of the essence of the problem, good communicator, comprehension of true necessities of the user, capability to recognize problems, ability to solve the problems of the user, good presenter, helping the user find out what his/her needs relating to IT are, completeness, qualification, ability to provide argument for personal attitude, ability to understand the user, ability to clearly define goals and objectives, being informed, clarity, good knowledge of information technology, ability to communicate at the user level, comprehensibility, ability to eliminate the users' fear of the unknown, self-confidence. The traits with the highest rating are predominantly related to: (1) problem solving; (2) information exchange with users; (3) persuasion; and (4) personal expertise. It must be noted that even this short list of traits is of substantial informative value. For instance, we can conclude that in interaction with users greatest emphasis could be given to *"solving the problems of the user and effective exchange of information with him/her in a persuasive and expert manner"*.

The factor analysis of the 150 traits rated by IT professionals produced several different solutions, but a *four-factor solution* was chosen above others since it was the most comprehensive, consistent and interpretable. Traits which constitute these four factors are presented in Tables 1 - 4.

Table 1. Traits associated with *first factor - Work effectiveness*

Traits	Factor loadings <sup>†</sup>			
	F1	F2	F3	F4
Good programming	.66			
Industrious	.62		.39	
Devotion to work	.60		.32	.32
Ability to organize	.58	.33		
Persistence	.57			
Inventiveness	.56			
Entrepreneurship	.54			.37
Being promising	.54			.31
Perseverance	.54			
Talent	.53			
Creativity	.53			
Ambition	.52			
Interest	.52			
Expertise	.51			
Diligence	.50		.43	
Being economical	.50		.31	

<sup>†</sup> Factor loadings below 0.30 are not presented in table.



Table 2. Traits associated with *second factor* – **Productive information exchange**

Traits	Factor loadings <sup>†</sup>			
	F1	F2	F3	F4
Ability to understand the user		.64		
Ability to communicate at the users' level		.63		
Ability to notice problems		.63		
Ability to provide feedback		.59		
Ability to clearly define goals and objectives	.31	.58		
Ability to explain ideas		.57		
Ability to educate the user		.57		
Ability to practically demonstrate to the user		.55		
Ability to eliminate the users' fear of the unknown		.55		
Ability to provide argument for personal attitude		.55		
Ability to comment and explain		.55	.33	
Ability to solve the problems of the user		.53		
Comprehension of true necessities of the user		.52		
Problem identification		.51		
Reasoning ability		.50		
Helping the user find out what his/her necessities are		.50		

Table 3. Traits associated with *third factor* – **Agreeableness**

Traits	Factor loadings <sup>†</sup>			
	F1	F2	F3	F4
Truthfulness			.70	
Honesty			.69	
Fairness			.63	
Good will			.63	
Objectivity	.31		.55	
Openness			.54	
Conscientiousness			.53	
Kindness			.52	.40
Impartiality			.52	
Consideration			.52	
Unambiguous expression			.51	.33
Generosity	.34		.51	

<sup>†</sup> Factor loadings below 0.30 are not presented in table.

Table 4. Traits associated with *fourth factor* – Sales related characteristics

Traits	Factor loadings <sup>†</sup>			
	F1	F2	F3	F4
Ability to win favor				.64
Likeability				.63
Ability to attain good business connections				.62
Ability to negotiate				.60
Pleasantness				.59
Business appearance				.59
Good salesman				.57
Attractiveness				.53
Knowledge of the market				.53
Ability to overcome the competition	.42			.52
Reputation				.51
Eloquence				.51
Ability to appear before an audience		.35		.51
Ability to persuade		.35		.51

### 5.3. Discussion

The results of factor analysis revealed the following components of competence in interaction with users of IT: (1) *work effectiveness*; (2) *productive information exchange*; (3) *agreeableness*; and (4) *sales related characteristics*. The most descriptive traits or “factor markers” in Tables 1 - 4 provide a more precise definition of these factors. How can we interpret the results of factor analysis?

Since products and services provided by IT professionals represent the *main reason* for their interaction with clients/users, the ability to *deliver quality within given time limits* is probably the most essential competency required of IT professionals. Therefore, the *work effectiveness* factor (*F1*) is a means for communicating *excellence of service* and *appropriate attitude* toward the client/user. We must note that two traits which define this factor (see Table 1), i.e. “*good programming*” and “*expertise*”, are related to technical skills and knowledge of IT.

Much interaction of IT professionals with clients/users is devoted to working out their problems, and the effective exchange of information. The traits which constitute the factor of *productive information exchange* (*F2*) are important for achieving *mutual understanding*, as well as for the *empowering* of the client/user to put the IT to use.

The *agreeableness* factor (*F3*) is essential for developing the gratifying interpersonal relations of IT professionals with clients/users, and for the development of trust and cooperation. One can easily foresee the far-reaching negative effects of expressing traits opposite to those listed in Table 3.

Finally, the factor of *sales-related characteristics* (*F4*) emphasizes traits which contribute to the selling of IT, i.e. that represent *business-related knowledge and skills* which should be utilized by IT professionals in sales activities with clients/users.



The uncovered factors of competence in the interaction of IT professionals with clients/users correspond to non-technical competencies listed earlier in this paper. Problem solving, creativity and innovation could be linked with factors *F1* and *F2*, oral and written communication skills with *F2*, interpersonal skills with *F3*, and business knowledge/skill with *F4*. These uncovered factors could also be associated with our earlier definition of competence, i.e. *F1* and *F2* could be associated with adaptation, *F4* with control, and *F2* and *F3* with cooperation.

## 6. CONCLUSION

Information systems (IS) specialists have recently been viewed as important agents of organizational change [17]. Products of their work are crucial for the global competitiveness of their organizations. The complex, turbulent and competitive business environment of IT professionals creates the demand for the development of non-technical competencies like problem solving, communication skills, teamwork, and business skills.

The situations in which IT professionals interact with clients/users are among the most important for their career and business success. Empirical research of competencies needed in such interactions, presented in this paper, revealed four factors which contribute to the overall competence of IT professionals: work effectiveness, productive information exchange, agreeableness, and sales-related characteristics.

The method which was used has proven informative and effective for this specific subject and domain, but its application could be expanded to other non-technical competencies of IT professionals, as well as to different vocations. However, we must note that there have been other efforts to empirically identify general communicator characteristics which contribute to communicative competence [21]. Furthermore, non-technical variables, related to the successful performance of IT personnel, which could be utilized in processes of selection, have also been analyzed by other authors with a focus on personality traits [3].

Finally, we would emphasize that designing a college curriculum to meet the requirements of future IT professionals could rely on research findings like those presented in this paper. Also, we have illustrated the necessity for the non-technical education of future IT professionals in creativity and innovation, communication and interpersonal skills, and business/selling skills.

The curriculum at the Faculty of Organization and Informatics in Varaždin, Croatia, is oriented toward providing future *IS designers* with exceptional technical knowledge, and also with knowledge and skills from non-technical areas like management, economics, decision-making, communication, etc. There is much correspondence between this undergraduate college curriculum and the research results presented in this paper on the non-technical requirements of IT professionals, and also with the *Model Curriculum for Undergraduate Degree Program in Information Systems* which has recently been proposed by numerous experts in this area [6]. Since there are many indications that the IT profession will continue to be among the leading and most important vocations in the decades to come, we

emphasize that the up-to-date education and training of future IT professionals should not be our objective of tomorrow, but of today.

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## NETEHNIČKE KOMPETENCIJE KOJE SU POTREBNE STRUČNJACIMA ZA INFORMACIJSKE TEHNOLOGIJE: KAKO DJELOTVORNO OBLIKOVATI INTERAKCIJU S KORISNICIMA?

### Sažetak

*Brze promjene u informacijskim tehnologijama (IT) i reorganizacije poduzeća, koja se nalaze u iznimnoj konkurenciji na svjetskom tržištu, postavljaju sve veće zahtjeve pred informatičare i druge stručnjake za IT. Porast kompleksnosti programske podrške i zahtjevi za ekonomskim osnovama u primjeni IT u organizacijama, kao i promjene u sustavima rada, traže od stručnjaka za IT različite vidove kompetencije. Nakon razmatranja netehničkih oblika kompetencije, koji su od važnosti za stručnjake iz IT, daju se rezultati empirijskog istraživanja činitelja kompetencije informatičara na užem području interakcije s korisnicima.*

**Ključne riječi:** informacijska tehnologija, softversko inženjerstvo, kadrovi, kompetencije, komunikacijske vještine, program fakultetskog studija.