What Will the Future of Work Look like for IS Professionals? The Picture of Portugal

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Abstract. Many professions, in the most diverse sectors of activity, have undergone great changes over time, largely due to the responsibility of technological evolution.

The rapid evolution of information technologies will, certainly imply, that employment in general and employment in Information Systems (IS), in particular, undergoes major changes both in terms of creating new professions and even for the extinction of others, as indeed it has already happened when professions such as telephone operators, typists, telegram distributors, typographers and even encyclopedias sellers disappeared.

The purpose of this article is to analyze the changes that can be expected in employment in IS for 2030 - how will work in IS be: what professions will be extinguished, which ones must adapt to the new reality and what the need for professions that do not yet exist.

After a review of the literature on the evolution of employment in IS over the years, realizing the trends of its evolution, a guide was elaborated for semi-structured interviews that were used in meetings with 6 (six) Portuguese organizations, in order to list their perceptions of the changes that are expected in the very near future.

From the analysis of results, it will be possible to have a clearer idea of the changes that are already occurring today, as well as what still needs to be changed. This answer will allow us to reflect on how to prepare tomorrow's professionals, in IS, for the job market in 2030.

Keyword: IS employment, Employment trends, Technical skills, Socio-behavioural skills

1 Introduction

Due to technologies, we are witnessing great developments in society and organizations. Besides the changes being visible in the business models, in communication and collaboration, in the relationship between working and private life, in the structure and organizational hierarchies, technologies are also impacting the employment itself. This scenario requires citizens and employees to master the technologies as they constitute a fundamental pillar for any organization. In this changing context, employment in general, is a subject that deserves attention. As such, it is necessary to have a clear idea of the transformations that are taking place in order to be able to project trends, specifically with regard to the technical and socio-behavioral functions that support citizens' skills. Previous studies on the area of IS [6], [35], [7], [9], [9] show that the skills required to carry out the different IS jobs have changed over time. According to Cheney at al [6] job skills obsolescence has been a common topic of interest for many years. Some studies [2], [6], [5] have been carried out with the aim of anticipating which skills are more likely to be necessary for future employment. In this regard, there is no reason why the particular case of IS employment should be an exception. And by IS professionals, we understand those being experts in developing, applying, modifying, and strategizing technology to digitally change organizations. IS professionals work with other business professionals including computer scientists and engineers to create platforms that integrate digital technologies to design solutions that solve organizational problems [18], [10].

The youngsters who entered school in 2010 will be professionals in the decade of 2030. In the IS area, it is certainly expected this employment to be different from today as a result of various alterations being observed, such as technological evolution, globalization, and demographic change. The professions, and the skills to be displayed, should be in line with the needs of the 2030 labor market. Thus, it is necessary to understand the context where these changes are taking place, to have a clear picture of how we got here and the possible trends for the next 10 years. This should cover a complete and thorough understanding about the scientific knowledge, technical and soft skills that should be developed by each student during his education and training. While there is no consensus on how to categorize these different types of specific skills, in this work we will consider two different broad types of skills: technical skills and socio-behavioural sills. The former are often associated with disciplinary knowledge, while the latter are sometimes alternatively referred to as soft skills or individual foundation skills [9].

Knowing in advance what are the changes that might happen in a certain profession, will allow educational institutions to be ready and better prepared to educate and train students for a future that no one knows how it will be, by updating curricula and contents, more adequate for the uncertain moments we will face. And as changes do not take place all over the world at the same time and in the same way, we will focus our research in Portugal.

This article is structured as follows: the next section presents a historical evolution of IS employment followed by a perspective on the future of work in this area, together

with a reference to the Structuration Theory that guided us in this research. The Methodology section presents the procedures used to collect data. Section 4 presents and discusses the results. Finally, we draw some conclusions, refer the limitations of the study and coments for future research.

2 State of the Art

2.1 History of the IS employment

Although the IS area does not yet take us to go back many decades, employment in IS has changed over its short existence and is expected to continue to change [1].

In this section we look at the evolution of IS employment in the last 50 years. This historical overview shall help us understand the relationship between the main trends in IS employment over this period, as well as its transformation in terms of skills, from a merely technical to a more diversified set of skills.

In the 1970-80s, IS professionals were required to have strong technical skills and a very specialized nature for professions such as functional analyst, organic analyst, programmer, or systems administrator. These professionals, specialized and with funnelled disciplinary knowledge, worked in "islands" with some capacity for dialogue and professional understanding with the "side island". We lived in a phase in which the paradigm in which we believed, and which we followed, in the IS development, was the 'waterfall model'. Each professional performed a specific function at a certain stage in the cascade, thus narrowing the scope of their technical knowledge.

In the 1990s, IS professionals were also required to have business and organizational knowledge, in addition to their technological knowledge. This change coincided with the evolution of the IS role in organizations, from being seen as simply automating activities / functions to being seen as something that adds value to the business. Then, we started talking about other professions, such as systems analyst, IS project manager and database administrator.

Continuing the temporal crossing through IS employment, it can be said that in the last years, in addition to technological, management, and business knowledge the importance of socio-behavioural skills has become more widely acknowledged. Namely, teamwork, time management, communication, leadership, and conflict management, which begin to be evaluated and appreciated by employers. This is a period when the need for highly funnelled technological knowledge begins to decrease due to the growth of team projects, where different professionals dialogue with each other in the common attempt to solve a problem. In this context business analyst, CIO (Chief Information Officer) emerged as new IS professions.

There has been notable growth in the recognition of other behavioural competencies, such as creativity and critical thinking. This is not surprising since IS is beginning to be seen as a lever for innovation, and the concept of digital transformation has become commonplace. At the same time, there has been a rapid growth in new information technologies, which translates into the emergence of new professions, such as that of data analyst. Moreover, there is also a fragmentation of the programmer profession into a web, multimedia, and DevOps programmer.

However, the current need for rapid IS developments, coupled with the growth in the use of agile methodologies, has led to the integration of the function of systems analyst, requirements engineer, programmer, and tester. This means that IS professionals are now required to have a comprehensive range of technical skills which before were distributed among different specialized professionals.

Thus, it can be observed that, over time, the path of increasing specialization / funnelling of the skills of IS professionals has not taken place in terms of technological knowledge. On the contrary, there is an evolution towards increasingly broad requirements, in a multitude of technological, management, and business knowledge, also accompanied by an increase in the demands for socio-behavioural skills.

2.2 What does the literature says about the future of employment in IS

It will be, at least partially, a futurology work, to identify the IS professions for 2030. Nevertheless, according to the market vision, it is recognized that information technology will be increasingly present at all organizational levels supporting and even replacing, some of the current professions [2].

We are all aware that some professions will disappear due to the growing presence of information technologies in organizations, but for the same reason, new ones will appear. Human beings, although they like to live in good conditions, which implies less work, more free time, and more profitability - factors where technology can act and contribute positively - will not, however let themselves be overcome by the machine [19]. Intelligence systems, among other emerging technologies, may seem frightening, particularly when associated with the forecasts for the evolution of employment until 2030. These technologies may lead us to fear that employment will disappear, become obsolete and replaced by robots, sensors, machine learning, chatbots, ... Certainly, improving living conditions will involve fewer hours of work, more free time, remote work, and an increase in productivity, aspects on which information technologies can and should contribute positively. Anyway, it is hardly believable that all human work can be replaced by machines [3], even if it has to be better prepared to witness significant changes, with ever shorter cycles [21].

According to the World Economic Forum [2] in general, an increase in employment in math and computer-related employment households, a moderate decline in manufacturing, and a large decline in jobs related to administrative work are expected in the next years. In addition, and more transversally, disruptive changes in industry and business models will also affect the quality and skills needed to perform any kind of task.

The analysis of several studies, such as Burns, et al. [4], [5], [6], [7], [8], [9], [10], reveals that talking about employment in 2030 is recognizing a set of skills necessary for people to contribute to and benefit from an inclusive and sustainable future. It is not unreasonable to recognize the growing importance of technical skills associated with the area of STEM (science, technology, engineering, and mathematics). However, competencies such as adaptability, creativity, collaboration, curiosity, autonomy, reconciliation of tensions, social responsibility, and ethics will also be needed. In parallel, accepting that the different areas will be increasingly supported by technologies means

that it will also be necessary for IS professionals to be able to work in an interdisciplinary context. Thus, one is led to think that, in addition to the technical skills in the area of technologies, and in addition to the socio-behavioural competencies, these professionals should accumulate thematic skills, related to the specific areas in which they will exercise their activities (e.g. health, agriculture, law).

It is expected that IS professionals will be required to have, in the future, technical skills in areas such as digital experience, analytics, cloud, virtual reality, blockchain, cognitive technologies. One cannot forget that the information technologies that may have an important role and impact in business and society in general, is transitory, rapidly changing, being necessary to have skills allowing people to act, if possible, in a proactive and creative way, in this new digital world in constant change. However, literature also points to the future need for non-SI professionals to have more and more technological skills.

In a recent study provided by Blue [11], there are 5 things we need to know about the future of work: 1) technological skills will continue to dominate tomorrow's jobs; 2) human skills are still important; 3) with the evolution of jobs, women are locked out; 4) there is an untapped talent to fill the gaps in emerging jobs; and 5) networks still matter.

According to the Internet of Business [12], the IS jobs that will endure in the coming years are those related to data analysis, artificial intelligence and machine learning specialists, innovation and digital transformation experts, robotics professionals, user experience and interaction designers, process automation experts - all roles that machines will have difficulty replicating.

According to the Business Insider [13], the 13 (thirteen) best technology professions in the future are web developer, mobile applications developer, change manager, business intelligence analyst, change consultant (transformation consultant), data engineer, machine learning designer, software developer, business intelligence architect or developer, designer, developer or not engineer, cyber security engineer or analyst, network engineer or architect, security management specialist.

As can be seen from the above analysis, the trends are not conclusive, however, they all point to a different picture of IS skills and professions. In addition, taking into account the profiles and professions that seem to emerge, one can speak of a multidisciplinary range of competencies, pointing to the need to prepare "supermen", as mentioned by Nascimento [14].

Although in Portugal it continues to have one of the lowest percentages of professionals with specialized skills in Information and communications technology (ICT) in total employment and the number of the ICT graduates is low by EU standards [31], the trends within IS employment itself have followed the global trends.

To be sure, several studies have been recently published about digital skills, 21st century skills, e-competences, and the changing nature of work in the digital age, exploring what this may entail for the future of jobs and the labour market [2], [6], [8], [9], [10], [20], [21], [22], [28]. However, no significant research contributions of a similar nature can be found for the specific area of IS employment. This study offers a first contribution to start filling in this gap.

2.3 Structurational Model of Technology

Over the last decades there have been several the development of several lens through which one could look into an organization. The models of Technological Imperative and the Strategic Choice represented the two opposing ends of a continuum. The contribution of Giddens (1984) [32] allowed the emergence of another model, proposing an integrative meta-theory – the theory of structuration. This theory recognizes and accommodates both the subjective and objective dimensions of social reality and considers the duality and dependence of structure and action. Moreover, it also suggests that human actions simultaneously condition and are conditioned by institutional properties in social contexts. According to the Structuration Theory, organizational change is the joint effect of the actions of individuals interacting with institutional structures which enable and constrain the daily actions and thought processes of people, but do not completely determine them. People's choices are not independent of the structures where they take place as they can maintain, reinforce, change or destroy them. This interplay is seen as the duality of structure and is the basis that changes are not completely predictable.

Later, based on this theory, Orlikowski (1992) [33] proposed the Structurational Model of Technology, in which the dual nature of Information Tehnology (IT) is at the heart of the structuration process. As such, organizations are not only shaped by IT but they are also influenced by social and political processes and by the actions of members of the organizations. This theory comprises the following elements: a) human agents – technology designers, users and decision makers, b) technology – material artifacts, mediating task execution in the workplace and c) institutional properties of organizations, including organizational dimensions such as structural arrangements, business strategies, ideology, culture, control mechanisms, standard operating procedures, division of labor, expertise, communication patterns, as well as environmental pressures. This theory can be synthetized in the Figure 1.

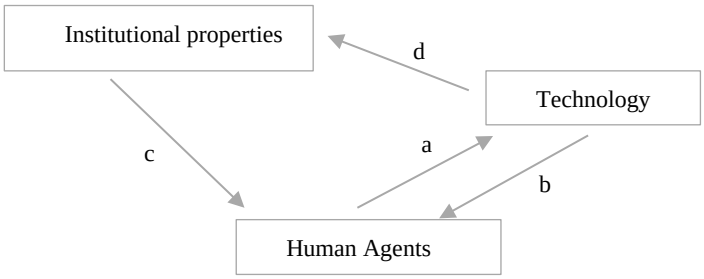

Fig.1. Structurational Model of Technology
Source: Orlikowski (1992) [33]

Technology is the product of human action (arrow a) and it comes into existence through human action and is sustained by human action through the ongoing maintenance and adaptation of technology. Moreover, human action constitutes technology

through using it. This means that once created, technology is only given meaning when is manipulated by humans. It is only through appropriation of technology by humans that it plays a significant role.

Technology is the medium of human action (arrow b), because when it is used, it mediates the activities. One needs to be aware and recognize that technology cannot determine social practices. Human agency is always needed to use technology and this implies the possibility of choosing to act otherwise. Thus technology can only condition social practices by enabling and constraining them which are, by their turn, dependent on multiple factors.

One influence concerns the nature of human actions in organizations, which is situated action, and hence shaped by the organizational context (arrow c). When acting on technology, human agents are influenced by the institutional properties of their setting as they draw on existing knowledge, resources and norms to perform their work.

The final influence is related with the way in which human action, while using the technology, acts upon the institutional properties of an organization (arrow d), either by reinforcing them or by transforming them. The construction and use of technology is conditioned by an organization's structures of signification, domination and legitimation. The appropriation and use of technology implies the change or reinforcement of these structures and these effects are not, usually, reflected on by users. When users conform to the technology's embedded rules and resources, they are sustaining the institutional structures in which technology is deployed.

In the model proposed, structuration is seen as a dynamic process. While the main components and relationships are stable, their range, power and content will vary over time. Moreover, it is also considered to be a dialectical process as it assumes that their elements will interact recursively.

In the context of the present research it is possible to see that there is an appropriation of technology by organizations with a certain objective. Due to the characteristics of the technology, these have the power (in the sense of "possibility") to change the way people work and as such, their jobs as the processes and structures change accordingly. However, as also evident from the Model, these changes will be filtered (enabled or constrained) by the users, which are influenced, direct or indirectly by the characteristics of the organization, including its culture. According to this, it will be very difficult to point clear direction for the future of the IS job (as many factors are involved, including the interaction that will be established between the agents and the technology, mediated by the institutional properties). Yet, one can describe the present moment and draw some lines for the future, assuming that no other factors will influence this dynamic.

3 Research Methodology

After the identification of the main keywords taking into consideration the research question and the objectives, the work proceeded with the literature review which was based on a set of academic articles accessed via electronic databases (b-on) and, due to the nature of this investigation, also on articles prepared by management consultancies

and international organizations, accessed online. The literature review allowed the preliminary identification of the major trends regarding employment in IS in Portugal for the future and the collection of information to be applied in complementary data collection techniques in order to further specify and characterize these trends and draw conclusions. Even so, there is no list of standard technical and socio-behavioural skills: the final list used in the interview guide is a compilation of the comparison of the lists found in research work carried out.

Based on the objectives to achieve in this research, the qualitative approach seemed to be the most appropriate methodology to adopt to further understand the phenomenon under study [15]: "... qualitative research aims a broader understanding of the phenomena". On one hand, the qualitative approach involves those who experience the phenomenon, in this case, those who deal with different human resources in the IS area; on the other, it allows the collection of information with the objective of obtaining all possible data, through the use of an adequate set of sources such as interviews (our main source of data collection), observations, of those involved (in this case, those dealing with employment in IS) [16].

Moreover, the case study method, often used in qualitative research, proved to be, also, the most appropriate methodology. It enables the researcher to answer “how” and “why” type questions [17] while studying how a phenomenon is influenced by the context within which it is situated. Case study research is compatible with the analysis of a broad range of data sources such as: documentation, archival records, interviews, physical artifacts, direct observations, and participant-observation. In this research, we relied on interviews to collect data. Content analysis was used to analyze data as it is referred, in the literature, as credible (Zhang and Wildemuth 2005) [37], with the consistency of the study process and the way of documenting, and also regarding the exposure of data that can be confirmed by third parties, readers and / or future reviewers.

Despite the literature review revealing the existence of some studies already carried out, we developed a set of questions and concerns based on the comparison of the lists found in research work conducted by other authors (as referred) which lead to the development of a script to be used in the semi-structured interviews: as we created the list of technical and socio-behavioural skills based on the studies found in research, we eliminated repeated assignments, to build the final sequence; for the professions the research focused in papers and in employability sites.

These questions allowed us to gather opinions about technical and socio-behavioural competencies, and to identify trends in Employment in IS in Portugal. In order to allow an interpretative analysis, we resort to staff from Portuguese business organizations linked to the areas of Recruitment and to Information Systems and Technologies, as these are respondents with more experience in this topic. The script guided the interviews made with the respondents to be mentioned: these are a useful means of data collection (in this case by the commented answers) as mentioned by Creswell (2003), [38] scientifically recognized (Castellan 2010) [39].

As said above, for the interviews, we identified respondents linked to the areas of Information Systems and Technologies and Recruitment from companies in different sectors. We contacted seven companies in Lisbon and four in Porto, but only four in Lisbon and two in Porto agreed to participate in the research (see table 1):

Table 1. Cases studies characterization

Sector	Role	Region
Food	Senior management with responsibility for human resource management	Lisbon
Information Systems and Technology	Senior management with responsibility for human resource management	Lisbon
Information Systems and Technology	Senior management with responsibility for managing team projects for its clients	Lisbon
Telecommunication Consultancy	Contractual functions in project management and its team	Lisbon
SPGS	Senior management with responsibility in the Information Systems area	Porto
Outsourcing in Information Systems Technologies	Managing Partners & Founder	Porto

The interviews took place in the interviewees' offices, and in the case of those that took place in Porto, the Human Resources Director was also present. After the interviews, the content was compiled on excel tables, and worked afterwards.

From the responses collected in the semi-structured interviews, it was possible to identify two evident broad categories: “Current IS Competencies” and “Future IS Competencies” , to which were added the “Evolution of IS Competencies” , the “Professions Issues” and the “Nature of Job Contracting” categories (see table 2).

Table 2. Competences category explained

Category	Purpose
Current IS Competencies	To identify current IS competencies using the lists prepared and exemplified in the script
Future IS Competencies	To identify future IS competencies using the lists prepared and exemplified in the script
Evolution of IS Competencies	To identify differences between current and future IS competencies listed in the script
Professions Issues	To identify job types, organization’s areas, mastery degree of competences in actual and new collaborators and competences relevant in 2030
Professions Types	To identify which professions continuos to exist and the ones who disappear
Nature Job Contracting	To identify nature of job contracting

This work allowed us to identify the main contributions to the objectives of the research and for each category we can infer, in the light of the initial objectives, the information available after the interviews: the technique of propositional discourse analysis was applied to the interviews made [16].

In summary, after building the script and defining the number of respondents, the interviews reveal the views of those in the market about the current and future IS Competencies, as well as those that suggest adding as pertinent to the original list of the

script and also relevant aspects about IS professions and forms of hiring. Analysis and results discussion is made in the next chapter.

4 Results and discussion

This section presents the main results based on the 6 semi-structured interviews. The main objectives of the interview were i) to identify which are the most likely technical and socio-behavioural skills required to IS professionals in 2030 in comparison with those which are currently required, ii) to understand how the IS job is expected to change, and iii) to anticipate what new IS jobs may be created and, conversely, what IS jobs are likely to disappear. The section also discusses the main trends in IS employment till 2030 and, in this light, how to best prepare tomorrow's IS professionals.

4.1 Results

Regarding the current technical skills valued by the respondents, there was an unanimous reference to the importance of 8 of them, namely Data Analysis, Systems / business analysis, Analysis and evaluation of "user experience", Portfolio management, Project management, Risk management, Requirements identification and management, and Systems integration. However, in the case of the 2030 scenario, only one technical competence was referred by all the interviewees, namely Systems / business analysis.

Table 3 presents, for each technical skill initially considered, the number of respondents who chose it, taking into consideration its importance, now and in the future. The variation trend is also presented.

Table 3. Thecnical skills: Present and Future

Technical skills	Present	Future (2030)	Trend
DB administration and management	5	2	↓
Algorithmics	5	3	↓
Data Analysis	6	5	↓
System / business analysis	6	6	→
Analysis and evaluation of "user experience"	6	5	↓
Business and enterprise architecture	3	3	→
Network design and support	4	3	↓
Portfolio management	6	4	↓
Project management	6	5	↓
Risk management	6	5	↓
IS Governance	5	5	→
Requirements identification and management	6	4	↓
IT infrastructure	5	4	↓
Systems instalation	3	3	→
Systems integration	6	5	↓
Digital Marketing	2	3	↑
Mathematics	5	3	↓
Business and systems modelling	5	4	↓
Monitoring emerging technologies	4	3	↓
Software programming	4	3	↓

Information security	5	4	↓
Software systems	4	5	↑
Standards	1	1	→
Software tests	4	2	↓

Legend : ↓ decrese; ↑ Increase; → stable

When requested to order these skills by importance, both in the present and future outlooks, one company did not respond, and two others only did so for the 12 skills that they considered to be the most important. In any case, each of the companies where the interviews were made, identified a different skill as the most important one.

Seventeen new technical skills were added to the original list by the respondents; however, only one skill was identified by 2 different companies, this being Artificial Intelligence. Each of the other skills was added by a single company only. It was also noted that only three of these skills (Rapid Application Development, Continuous integration / delivery, Product management) were considered necessary today, but not for 2030. The justification for the need of these skills is associated with market trends, namely greater storage of data in the cloud, the growth of agile development and new technologies (such as artificial intelligent, predictive analysis, low code, services in demand, simplification of software development, application portability) already in use but expected to expand further in the future. However, the companies interviewed did not reveal unanimity in their responses. Responding companies also revealed that technical skills will be needed at all levels and functional areas of organizations and not only in the areas of software design / development.

When it comes to socio-behavioural skills (table 4), it was found that 8 of these were listed by all companies as relevant today, but only 4 were expected to remain important in the future, namely Openness to opinions, Critical thinking, Problem solving and the Ability to listen.

Table 4. Socio-behavioural skills: Present and Future

Socio-behavioural skills	Present	Future (2030)	Trend
Openness to opinions	6	6	→
Abstration	4	4	→
Adaptability	6	4	↓
Lifelong learning	4	3	↓
Assessment of the performance of oneself and others	6	4	↓
Collaboration	5	5	→
Written and oral communication	4	3	↓
Coordination	4	5	↑
Creativity	5	3	↓
Risk Management	5	5	→
Identificaiton of new opportunities	5	5	→
Emotional intelligence	6	5	↓
Leadership	4	4	→
Critical Thinking	6	6	→
Systemic Thinking	5	5	→
Persuasion	5	4	↓
Problems Solving	6	6	→

Putting oneself into someone else's shoes	5	5	→
Ability to listen	6	6	→
Decision-making	5	5	→
Transmitting knowledge	6	5	↓

Legend : ↓ decrese; ↑ Increase; → stable

Regarding the ranking of these socio-behavioural skills in terms of relative importance, both in the present and in the future, one of the companies did not respond. However, for each of those that responded, the rank for the importance of the socio-behavioural skills in the present was: Abstraction, Leadership, Collaboration, Assessment of the performance of oneself and others and Problem solving, with each of these skills having been singled out by a different company. Regarding future socio-behavioural skills, two companies gave greater importance to the Abstraction, and the remaining three chose each a different skill, namely Adaptability, Assessment of the performance of oneself and others, and Leadership. Only in one case was the ranking increased; the company that currently considers Problem solving as the most relevant socio-behavioural skills considers that, by 2030, it will be Adaptability.

Nine socio-behavioural skills were added to the original lists. It is observed that each company added different skills; however, only one company added skills which it considered would be needed for 2030 but were not yet needed today. These are: Interpersonal relationship and Strategic vision with interest / knowledge of the business in which one operates. The remaining skills added by the other respondents as needed today are also listed as important for 2030, namely: Entrepreneurship, Social responsibility / sustainability, Conflict management, Negotiation skills, Assertiveness, Learning from failures, Initiative and Proactivity. One company justifies the need to add other socio-behavioural skills due to market trends. Another company justifies that all technical skills (except skills in standards) combined with the socio-behavioural skills listed in the interview guide, plus two skills that they added to that list (Interpersonal relationship and Strategic vision and knowledge of the business in which it operates) will comprise the main characteristics of the IS professional of the future.

In general, the companies interviewed consider that technical skills are reasonably well-developed today in IS professionals; however, socio-behavioural ones could be better exploited. Companies emphasize that technical skills will remain important but will tend to lose ground to socio-behavioural skills, both becoming equally important in the future. A company considers that the employees' socio-behavioural skills will contribute to boost or constrain the development of technical skills; it is recognized that socio-behavioural skills are more difficult to change.

The table 5 shows the number of responses for how companies anticipate the nature of IS employment in 2030 (1 unlikely to 5 very likely).

Tabela 5. The IS employment in 2030

Nature/ Degree probability	No answer	1	2	3	4	5
Self-employed (individual)				2	1	3
Employment contract			1	4	1	
Part time	1		1	1	2	1
Full time	1		1	2	1	1

In the office		2	3	1	
Remote			1	3	2
Blended (in the office and remote)			1	3	2
Job for young people	1		1	3	1
Job for seniors (with several years of experience)			2	4	

Regarding the 19 listed jobs, companies were asked to predict which ones are more likely to disappear by 2030 and why. Fifty percent of the respondent did not answer this question. The only jobs mentioned by more than one company were: Developer, Desktop or enterprise applications (3 companies), System administrator (2 companies) and Database administrator (2 companies). The jobs identified by a single company, were: Developer, full stack, Developer, back-end, Marketing or sales professional, Engineer, Site reliability, Data scientist or machine learning specialist and Chief information officer. The reasons given were the tendency of increasingly use the cloud, most of the systems being web, available as a service and the evolution from monolithic to simpler integrated systems.

As for the 5 jobs that they considered to be the most relevant, there is a trend towards the analytical component, which is now embedded in all employees (user experience), in the areas of security and integration. The importance, the security of information and systems, the holistic aspect of projects, and the digital transformation are the aspects pointed out as the reasons for the trend towards these professions in the future.

4.2 Discussion

This study suggests an almost generalized decrease of the importance, in the future, of those technical skills compiled through the review of the literature. However, this decrease is not significant. On the other hand, a new extended set of technical skills (17 in total) was advanced by the respondents, which attests the dynamic of the evolution of technological knowledge.

The growth of the cloud, accompanied by the progress of the automation and the artificial intelligence, will have repercussions in professions such as administrator and manager of data and network systems. Simultaneously, the market growth in the adoption of the so-called emerging technologies will justify the need for technical skills in the areas such as: Virtualization / Cloud, Automation/Artificial intelligence, Analytics/Business intelligence and Big Data.

Respondents recognize that the technical skills currently needed are, in general, reasonably well developed. However, there are still those who think they are lower than what is required. The dissatisfaction is greater when it comes to socio-behavioural skills, although there is the expectation that these skills will improve with younger generations. In any case, everyone agrees that by 2030, both technical and socio-behavioural skills will be required. In terms of socio-behavioural skills, there is a generalized growth in their importance and it is observed that four of them continue to be recognized as the most important ones: Openness to opinions, Critical thinking, Problem solving, and the Ability to listen. Among those listed, twelve socio-behavioural skills are expected to maintain their current importance, one is expected to become more important (Coordination), whereas eight are expected to become less important by 2030.

Adaptability, Lifelong learning and Creativity, which are skills frequently associated with the so-called digital transformation era, showing a decrease in importance by 2030, even though one respondent considered Adaptability as the most important competence for 2030.

In addition, it is expected that the professional of IS will work remotely and that this professional will become a liberal one. There is no clear trend as to whether this will be a job for young people or for seniors, nor whether it will be carried out by full-time or part-time employees.

Finally, it should be noted that it is not possible to predict which are the five main IS professions. However, there is a trend towards security and systems integration. And, although It is also not possible to clearly identify which professions will have disappeared by 2030, the most likely candidates seem to be desktop developer, enterprise applications developer.

This study shows that information systems will increasingly become a commodity in organizations, where business and information systems and technologies will intertwine even more over time. Business professionals will start to develop their own systems and the development will be increasingly one of small systems that will be integrated with each other, according to the needs of its users. In this way, it is expected that the CIO, with the role and profile it currently has, will cease to exist, instead assuming a new, more diluted role within organizations, mainly concerned with organizational guidelines at the level of emerging technologies. These changes will be underpinned by the democratization of information technologies and low code tools. Consequently, even the profile of a system / business analyst, despite continuing to exist and playing an important role, will increasingly approach the end user owing to the need and importance of business knowledge.

Technical skills will remain important in the future, but they are not the only skills needed and may not even be the most needed skills. So, the IS curriculum must continue to offer three core types of skills as pointed by MSIS 2016 model graduate degree programs in Information Systems: Information Systems (i.e. technical) skills, individual foundational (i.e. socio-behavioural) skills, and skills in different domains of knowledge (predominantly business but also health, government, law, etc.).

Owing to constant technological evolution, the IS curriculum must be frequently reviewed so as to revise the technical skills it offers. This evolution also warns of the constant need for learning and developing new skills. So, the curriculum must be less rigid, offering flexible and elective modules, and more interdisciplinary, offering knowledge or practice in different knowledge domains.

In terms of socio-behavioural skills, the IS curriculum needs to continue to increase their relative importance. In addition, a more individual coaching and mentoring approach should be considered to help each future professional to develop the socio-behavioural skills that they need the most, and increase the use of problem-oriented learning methodologies, not only through internships in organisational context but also through the development of solutions for society and organizations

5 Conclusion and future research

The aim of this study was to have a perception of the trends regarding IS employment, towards 2030. In order to achieve the objectives of the research, a qualitative approach was used. A script was developed and experts from 6 different organizations were interviewed, allowing to obtain narrative summaries of the information collected through content analysis technique.

Results show that employment in IS will continue to last, opening up to new areas that do not yet exist, while, gradually, some professions with the profile and the name with which we currently know them, will subside and disappear. Automation will be a reality and will not only impact employment in other areas but will also promote changes in employment in IS. Automation will be used to reduce dependence on IT professionals, but the development of solutions will continue to grow. Moreover, information systems will increasingly become a commodity in organizations, where business and Information and systems technology (IST) will intertwine even more over time. Results also reveal that often, professionals with deep knowledge in a certain / specific area (technical, business, …) are also expected to have socio-behavioural skills.

Hybrid professional profiles are expected to grow in place of merely IS or IT profiles. This means that the "current" technologist will need more and more to raise requirements and the "current" business analyst will increasingly need to know about technologies.

IS employers recognize that the technical skills currently needed, in general, are reasonably well developed. However, there are still those who think they are lower than what is required. Regarding socio-behavioural skills, there is already a greater discontent, although believing that these will improve with the younger generations. Anyway, everyone agrees that in 2030, both technical and behavioural skills will be needed. In terms of the later, there is a generalized growth in their importance and it is observed that four of them continue to be recognized as the most important ones: Openness to opinions, Critical thinking , Problem solving and Ability to listen.

In addition, it is expected that within employment in IS there will be a trend towards distance work and for it to become a liberal profession. There is no clear trend as to whether this will be a job for young people or for seniors, nor whether it will be carried out by full-time or part-time employees.

Curricula within Universities must continually be adapted to the market needs. Organizations must blend traditional and new skills to effectively guide their organizations into the futures.

Finally, it should be noted that it is not possible to predict which are the five main IS professions. Anyway, there is a trend towards security and systems integration. It is also not possible to clearly identify which professions will disappear in 2030, however, the most likely candidates are developer, desktop, or enterprise applications.

As the limitations of this work, we would like to point out the fact that only experts, from 6 different organizations were interviewed. We strongly recommend the replication of this work, with more interviews and more organizations, from the IS sector and

HR companies. Moreover, this study was carried out in Portugal, a small and peripherical country. As such, other studies should be done in other countries so we can have a clearer picture about the situation.

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