

Professional Social Networks: An Essential Tool for Professionals and Companies in the Global Economy

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Abstract

This article presents a detailed analysis of 21 popular Professional Social Networks (PSNs) which are a means to allow workers to manage their professional profiles online. The functionality and principal characteristics of the PSNs are analyzed, including recruitment, security, privacy and communication issues, which are studied and exemplified using real cases. PSNs provide a variety of functions which use this work-related information to help both workers and companies solve problems, such as finding a job or personnel recruitment. According to our study, recommendation systems are essential in PSNs since they support all the decisions principally related to recruitment issues and are also capable of recommending courses, which will be of greater importance in the future. Finally, the impact of PSNs on workers and their search for jobs is studied by means of statistics regarding how people use the principal PSNs such as LinkedIn. Some advice is also offered to both applicants and recruiters in order to improve their effectiveness when using PSNs.

Keywords: Professional social networks, Recruitment, Privacy, Security.

1 Introduction

Social networks have made a great impact on human relations, thus allowing all our contacts to be managed through the Internet and online information to be propagated through spontaneous diffusion mechanisms [1]. The professional world (labor market) has also been influenced by this phenomenon [2]. Finding the best-qualified candidate for a job vacancy is currently a challenging task. Many companies have therefore chosen to use the Internet to find suitable profiles for their job offers. The traditional way in which to search for a job has also changed with the current tools that the new technologies provide.

The use of the Internet to recruit qualified candidates permits many companies to save time and money as compared to traditional recruiting through printed media such as newspapers and magazines [3]. According to a recent survey [4], 92% of companies use social networks to support recruitment efforts. Workers around the world are increasingly aware of the importance of maintaining their professional profiles online. A considerable amount

of social networks have thus specialized in managing this type of professional information: Professional Social Networks (PSNs).

PSNs are web communities in which users establish connections and interactions with other users within a commercial and professional context, whereas general social networks focus on informal exchange between users who establish relationships for fun or pleasure [5, 6].

In PSNs, users can keep their CVs online, manage their professional contacts, start new relationships and even apply for jobs. Recruiters are also finding good opportunities to identify and check candidates [7]. Companies can ask for CVs in response to a job offer, but they can also inspect other issues related to the workers such as contact networks, reputation and events. There are even web pages called content aggregators that are able to build a person's work profile automatically by crawling the web [8]. Note that PSNs can promote employment opportunities in the current period of economic crisis, which is affecting many countries in the form of a significant rise in unemployment. Indeed, the social cost of the crisis continues to weigh heavily, with more than 46 million people unemployed in OECD (Organisation for Economic Co-operation and Development) countries and relative poverty affecting millions more [9].

Professionals can therefore use PSNs to share ideas, find new business opportunities, publish or search for job offers, or create groups of people with common professional interests [6]. Some PSNs provide a general forum to connect professionals (e.g. LinkedIn), while others are focused on specific careers such as teaching (e.g. Classroom 2.0) or nursing (e.g. Nurse Connect). PSNs are also forums in which workers, users and companies participate in technical discussions. Workers benefit from these discussions because they enrich their knowledge and companies can also improve their products and services by means of workers' and users' opinions.

Some non-Professional Social Networks include tools to enable communication among professionals. For example, Facebook has a group called Software Professional in which over 4000 members [10] share information concerning job vacancies. However, in non-PSNs, information exchange is more informal because, as mentioned above, users exploit them mostly for fun and entertainment and are not allowed to separate their professional and personal issues. Moreover, non-PSN professional profiles are not as complete as those in PSNs.

As indicated above, PSNs have become indispensable tools, widely used by both companies and individuals for various purposes related to business, employment and

career development. PSNs could be thus considered a topical issue of substantial social significance. However, to the best of our knowledge, there are no other studies that address the field of PSNs in a systematic and yet practical way. In this sense, the main contribution of this manuscript is to study PSNs from a novel and applied point of view. On the one hand, a literature review was carried out using a sound and well-known methodology to gather the PSNs that are included in the study. On the other hand, a detailed analysis of these PSNs was performed, prioritizing those characteristics that could be more relevant for the systems' stakeholders. Starting from the knowledge gained through this study, guidelines and tips were generated in order to maximize the benefits of both applicants and recruiters when using PSNs.

The structure of this paper is as follows: Section 2 presents the methodology followed in order to identify, analyze and provide an overview of the principal current PSNs. For this purpose, we therefore selected a set of representative PSNs in which any user can create a complete CV without paying a fee. The PSNs included in this study provide sufficient functionality to exhibit workers' CVs, thus supporting their search for work. In Section 3, the PSNs selected are described, and information about their features and an overview of their evolution and popularity are also provided. Section 4 analyzes the PSNs in terms of functionality: communication, integration, recommender systems, and privacy and security. Section 5 offers both applicants and recruiters some advice as regards how they should use these networks. Section 6 gathers open issues and future directions in the development of PSNs. Finally, Section 7 highlights our conclusions and sets out future work.

2 Methodology

The PSNs were collected by means of a literature review that followed the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) statement [11]. PRISMA concretely makes available a checklist of 27 items with which to guide systematic reviews as shown in previous papers [12-16]. PRISMA is actually intended to help during the reporting of health care, but the lines proposed suit the purpose of our study and illustrate the usefulness of the model in any field of study. Decisions related to the protocol, standards used to validate the information and the PSNs to incorporate into the study were made in meetings held by the authors during the development of the survey.

2.1 Eligibility Criteria

The PSNs studied in this survey were selected on the basis of three criteria:

- IC1. This includes social networks with professional purposes (PSNs). These social networks offer a platform on which to interact with other professionals within a labor context: share business ideas, find jobs, find workers, etc.
- IC2. This includes PSNs that handle workers' profiles, i.e., PSNs into which workers can

introduce their professional profiles or CVs. The professional profile is useful as regards seeking jobs or receiving recommendations such as the most suitable job for users or courses to improve their CVs and obtain a particular job.

- IC3. Which considers PSNs that allow users to create professional profiles for free with at least three fields: personal information, academic information and work experience.

PSNs which consist of only a professional agenda in which users keep their work contacts are not studied. These PSNs do not keep a CV of each user and do not therefore include functions such as job seeking or job recruitment, the study of which is one of the goals of our survey. Freelance marketplaces such as Freelance, Odesk and Guru, which are not endowed with communication functionalities between workers and social interaction characteristics, were not therefore included. PSNs which only establish a forum in which to share ideas or opportunities are, for the same reasons, not within the scope of our survey. With regard to the IC3 criterion, premium profiles are not taken into consideration in our study.

2.2 Information Sources

We collected all the information needed to perform our study by reading articles from the following scientific libraries: ACM Digital Library, IEEE Xplore Digital Library and Science Direct databases. The searches took place over a period of three months between September and November of 2014. In order to complete our list, the Internet was also explored by following the systematic literature review guidelines proposed for software engineering [17].

2.3 PSN System Selection

The selection of the PSNs was organized by following the steps described below:

1. Firstly, we selected PSNs by carrying out a search of scientific libraries. A systematic review of databases was performed by means of searching the following strings: "list of social networks" or "list of professional social networks" or "professional social networks". The articles identified were analyzed to find concrete PSNs with which to form our list.
2. Selection of PSNs through similar searches to those in the previous step but using the Internet. A review of each paper and website found in order to extract social networks.
3. Exploration of social networks found. Extracting and reading the guide document and observing tools and features in order to dismiss those PSNs whose purpose is not professional (IC1 criterion).
4. Selection of the PSNs in which users can introduce their online professional profiles (IC2 criterion), by using free accounts (IC3 criterion).
5. Inclusion of the Plaxo and Zoominfo PSNs which have more than 50,000,000 registered users. After applying the protocol, two of the most

important PSNs, Plaxo and Zoominfo, were not included. Plaxo is a professional agenda which does not have professional profiles (IC2 criterion). Zoominfo is a non-free professional PSN which requires the use of at least Microsoft Outlook or Google Apps for Business (IC3 criterion). We therefore deviated from the protocol to include Plaxo and Zoominfo owing to their popularity and rich features.

To guarantee the accuracy of the information extracted, the selection process was performed independently by 2 authors. Moreover, in order to achieve as much consensus as possible, a measure with which to assess the inter-rater reliability was used. More specifically, Cohen's kappa rater was used iteratively until a coefficient of over 0.9, signifying high concordance, was attained [18].

2.4 Data Collection Process

The data collection was performed by analyzing 3 sources of information that PSNs provide:

- Documents regarding use policies, privacy and security policies and functionality.
- The PSN website. Additional information or use cases regarding the PSN usually appear on the website. Moreover, we tested the functionality that supports workers and recruiters such as recommender systems.
- Finally, the information presented in each professional profile was studied. Each PSN proposes a model of professional profile or CV that the worker has to fill out. The CV model of each PSN determines its functionality. For example, if a CV places more importance on research, there will be a function that allows users to find jobs related to their field of investigation. Thus, knowing the structure of the information that the workers can provide as regards their professional issues, provides a relevant insight into the functionality implemented.

In order to extract the information and test the functionality, the authors needed to have access to the PSNs as authenticated users. One author therefore registered and created his professional profile in each PSN.

3 Identification of Current PSNs

This section presents the PSNs identified in the review after using the search method described in the previous section. Evolution over time and the popularity of the PSNs are also analyzed.

3.1 Selected PSNs

Twenty one PSNs were selected in our review. Note that there are more than nine hundred social networks on the web and in scientific databases, although most of them are dedicated to social issues such as art, photos, cooking or sharing experiences [19].

In our search, we initially found 60 social networks, 33 of which we dismissed because they did not consider professional issues. Another 3 PSNs were then discarded

because they did not have professional profiles for workers. Five PSNs were excluded because it was not possible to create a professional profile for free, with at least the sections concerning personal information, work experience and studies. Finally, we recovered the Plaxo and Zoominfo PSNs, as mentioned above. This process is summarized in Figure 1.

Table 1 shows the list of 21 PSNs selected. The table is divided into three categories: (1) general PSNs (PSNs for any field of work), (2) PSNs which are available as Facebook apps and (3) specialized PSNs (PSNs focused on a specific field of work).

This table shows seven fields for each PSN: name, short description, website, creation of company page, creation of groups, number of registered members and year of launch. The "Company Page" and "Groups" columns indicate (using the symbols \uparrow -yes- or \downarrow -no-) whether it is possible to create a web page for companies and specific groups in order to discuss ideas or topics, respectively. The "Number of Members" column contains the approximate number of users extracted from the information on each website. In the case of BeKnown, BranchOut and Upspring, which can be accessed through Facebook, the number of potential users is estimated using the number of active users per month. In the case of Cofoundr, the number of members is not indicated since it does not have member searcher.

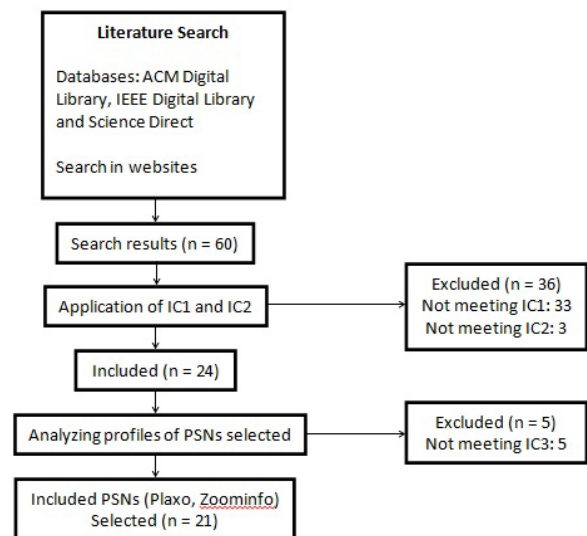


Figure 1 Process Followed to Select the PSNs of Which Our Study Is Formed

The last column shows the year in which each PSN was launched. Note that in the cases of Gremln, Proskore, SunZu and XING there are two dates. These PSNs were launched on the first date indicated but were then relaunched some years later under different names and incorporating new functionalities: Twaitter changed its name to Gremln, Fast Pitch to Proskore, Ecademy to SunZu and OpenBC to XING.

3.2 Evolution of PSNs

Upon observing the bar graph in Figure 2, it will be noted that most of the current PSNs appear from 2000 onwards, and that two key moments were identified in 2003 and 2007. The most important PSNs (LinkedIn, XING, Plaxo, Viadeo and Zoominfo), at least as regards the number of members, appear in an interval centered around 2002. Although many PSNs appeared later, the dominance of PSNs released from 2000 to 2004 suggests that timing was important [19]. In this period, important non-professional networks such as Facebook were also launched. This could be explained by the bursting of the Internet bubble, which gave less ambitious software an opportunity to shine, and the increasing amount of young people with experience in instant messaging who accessed the Internet in those years [19].

Since 2007, specialized PSNs have appeared, i.e., PSNs that are focused on highly specific professional fields, some examples of which are Classroom20, Nurse Connect and ASCD Edge. The potential users are only a specific group of workers who can offer or share resources more easily. This is the case of Classroom20 which contains a lot of ideas about how to use technology in the classroom.

New PSNs launched in recent years (e.g. BranchOut, Beknown, Proskore, Gremln, Upspring and SunZu) attempt to take advantage of the structure of other social networks in order to offer different ideas and functionalities. For example, Upspring provides a marketing platform with which to help companies increase their number of customers through social networking in Facebook, Twitter and Google+.

In order to obtain a measure of the growth of each PSN, which is independent of the year of launch, the ratio number of members / years since the PSN was launched was calculated (Figure 3). A PSN that was launched early may have more members, but its evolution might not be as important as that of a recent PSN. Figure 3 shows that LinkedIn, Viadeo, ZoomInfo, Plaxo and XING clearly achieve the five highest scores. Observe that these PSNs also have the five highest number of members, as reflected in Table 1. The success of these PSNs, which were launched before 2005, may be attributed to the snowball

effect: the higher the number of members, the higher the number of contacts and potential members these PSNs have. In contrast, specialized PSNs such as ASCD Edge, Classroom20 and Nurse Connect, which were created after 2006, are at the bottom of the ranking (Figure 3). LinkedIn stands out with more than 300 million registered users. The countries with most users in LinkedIn are the United States, India and the United Kingdom. The growth rate of the platform is two new members per second. LinkedIn users spend 17 minutes a month on the platform and 17,000 developers use the LinkedIn API with the objective of building applications which can take advantage of LinkedIn information.

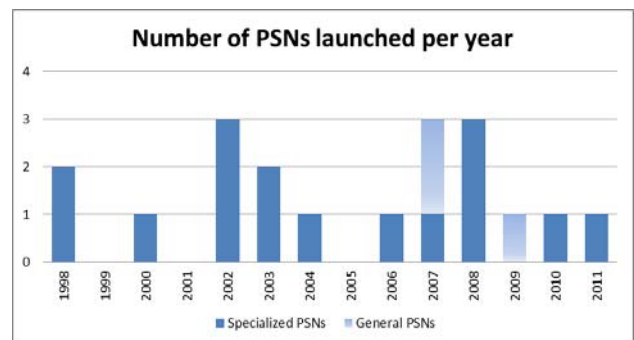


Figure 2 Number of PSNs Launched Per Year

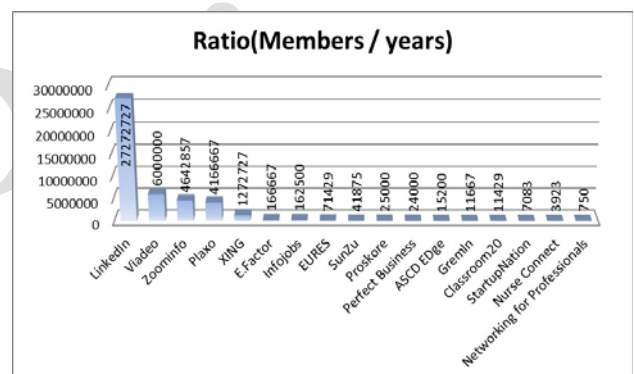


Figure 3 Number of Members Per Year

Table 1 List of PSNs Studied

| Name | Description | URL | CP | G | NM | YL |
|---|---|--------------------|----|---|---------------|-------------|
| General Professional Social Networks | | | | | | |
| Cofoundr | Community for entrepreneurs, programmers, designers, investors starting new ventures. | cofoundr.com | ↓ | ↓ | Not indicated | 2007 |
| E.Factor | Connects people, tools, marketing and expertise to succeed. E. factor has a system to recommend and contact the right people. | www.efactor.com | ↑ | ↑ | 1 million | 2008 |
| EURES | European PSN, which facilitates the mobility of workers within the European Union and Switzerland | ec.europa.eu/eures | ↓ | ↓ | 1,5 million | 1993 |
| Gremln | Marketing toolkit designed to take control of social media messages and measure their impact on customers | gremln.com | ↑ | ↑ | 70,000 | 2008 (2009) |

| | | | | | | |
|--|---|------------------------------------|---|---|----------------------------------|-------------|
| Infojobs | European PSN to help professionals and companies meet each other. Workers are recommended suitable courses. | www.infojobs.net | ↓ | ↓ | 2,6 million | 1998 |
| LinkedIn | The largest professional network that allows users to contact experts, find jobs, follow companies, create interest groups, etc. Recruiters and job seekers receive recommendations to support their decisions. | www.Linkedin.com | ↑ | ↑ | 300 million | 2003 |
| Networking for Professionals | Business network that combines online business networking and real-life events. | www.networkingforprofessionals.com | ↓ | ↓ | 9,000 | 2002 |
| Perfect Business | Used to help entrepreneurs to launch a new business and to provide business planning software and startup resources. | www.perfectbusiness.com | ↓ | ↑ | 144,000 | 2008 |
| Plaxo | Address book tool for networking and staying in contact, importing and updating the information from social networks. | www.plaxo.com | ↓ | ↓ | 50 million | 2002 |
| Proskore | Business network in which workers can connect with each other and measure their professional reputation. | www.proskore.com | ↓ | ↓ | 200,000 | 2006 (2011) |
| StartupNation | Used to exchange ideas between entrepreneurs and aspiring business owners, to create a business and allow it to grow. | www.startupnation.com | ↓ | ↑ | 85,000 | 2002 |
| SunZu | Used to find the right people in a small to medium business, based on the philosophy Know Me, Like Me, Follow Me. | www.sunzu.com | ↑ | ↑ | 670,000 | 1998 (2013) |
| Viadeo | Used to find new leads and partnership opportunities and contact industry experts in any sector. Viadeo has tools that allow jobs to be sought and personnel to be recruited. | www.viadeo.com | ↑ | ↑ | 60 million | 2004 |
| XING | Used to find jobs, manage events and participate in specialized groups and forums. XING has recommender systems to help recruiters and job seekers. | www.xing.com | ↑ | ↑ | 14 million | 2003 (2006) |
| Zoominfo | Used by companies to increase sales, improve their marketing campaigns or seek workers by means of expert information. | www.zoominfo.com | ↑ | ↑ | 65 million | 2000 |
| Professional Social Networks included in other social networks (Facebook) | | | | | | |
| BeKnown | Professional networking app on Facebook maintained by Monster.com with which to search for jobs and companies. | beknown.monster.com | ↓ | ↑ | 260,000 (monthly active users) | 2011 |
| BranchOut | The largest professional network operating in Facebook, which provides job seekers and recruiters with tools such as RecruiterConnect. | branchout.com | ↓ | ↓ | 330,000 (monthly active users) | 2010 |
| Upspring | Site for promotion and expansion of marketing strategy in social media (Facebook, Twitter, Google+, Youtube, Flickr and RSS) to help companies to grow. | www.upspring.com | ↑ | ↓ | 80 users /month through Facebook | 2007 |

| Specialized Professional Social Networks | | | | | | |
|--|---|---|---|---|--------|------|
| ASCD EDge | ASCD Edge develops solutions for educator development: books, conferences, best practices, etc. | ascdedge.ascd.org | ↓ | ↑ | 76,000 | 2009 |
| Classroom20 | Network for people interested in using collaborative technologies in the classroom: blogs, instant messaging, podcasting, etc. | www.classroom20.com | ↓ | ↑ | 80,000 | 2007 |
| Nurse Connect | Community for nurses and healthcare professionals: find new nursing jobs, obtain nursing career advice, get up to date with the latest nursing topics, etc. | www.nurseconnect.com www.nursingjobs.com | ↓ | ↓ | 27,459 | 2007 |

Note. CP: Company Page; G: Groups; NM: Number of Members; YL: Year of Launch (data collected on 11 November 2014).

3.3 Popularity of PSNs

In order to check how popular these websites currently are and to rate them, we have used four well-known rankings (Alexa, Google PageRank, Rank Compete and ranking.com) that are available on the Internet. Alexa is a company that was launched in 1996, which was taken over by Amazon in 1999 and has been associated with Google since 2002. Alexa establishes a ranking of websites (analyzing more than 3,500 million) with a measure that takes into account a combination of the estimated daily average of unique visitors to the site and the estimated number of page views on the site (www.alexa.com). Google PageRank gives each website a score of between 1 and 10. Google PageRank was developed at Stanford University by Larry Page and Sergey Brin in 1996 as part of a research project concerning a new kind of search engine. This score is calculated every three months using a mathematical algorithm based on a web graph of all the websites that takes into account the number of incoming links to the web. Rank Compete uses traffic factors such as unique visitors, page views or hits collected from the toolbars of 2 million of users and other sources to elaborate its ranking. The main difference with respect to Alexa is

that Rank Compete only analyzes US traffic. Finally, Ranking.com analyzes the traffic of more than 900,000 websites. Ranking.com uses its Browser Accelerator service (a BestSearch.com and 7MetaSearch.com search solution) and the company LinksToYou.com to determine website ratings by measuring the unique visitors, page views and link popularity of a website (www.ranking.com). Table 2 shows the popularity of the 21 PSNs studied. For example, LinkedIn is ranked as #11 in Alexa, #9 in Google PageRank, #20 in Rank Compete and #16 in ranking.com. Moreover, 1,920,213 sites are linked to LinkedIn, with 49,934,268 unique visitors. Note that there are differences among these rankings. For example, since Rank Compete only considers traffic from the USA, European PSNs like XING and Viadeo are harmed. The Spearman correlation has been used to calculate the correlation between each two rankings, but only taking into account the position of each PSN in its ranking, thus obtaining inter-rater agreements from medium (0,503) to high (0,760). This means that the rankings of popularity of the PSNs, calculated by using the four platforms, have an average to high level of agreement.

Table 2 Popularity of PSNs According to Alexa, Google Page Rank, Rank Compete and ranking.com

| | Alexa Traffic Rank (number of sites linked in) | Google Page Rank | Rank Compete (by USV) (number of unique visitors) | Rank by ranking.com |
|------------------------------|---|------------------|--|------------------------|
| Cofoundr | 648,813 (188) | | 3 N/A | 787,333 |
| E.Factor | 18,839 (1,950) | | 5 N/A | 36,703 |
| EURES | 776 (176,542) | | 6 N/A | N/A |
| Gremln | 93,782 (308) | | 5 N/A | 234,553 |
| Infojobs | 1,815 (3,780) | | 6 N/A | 95,038 |
| LinkedIn | 11 (1,920,213) | | 9 20 (49,934,268) | 16 |
| Networking for Professionals | 714,705 (188) | | 5 N/A | 135,378 |
| PerfectBusiness | 183,552 (162) | | 3 N/A | 536,477 |
| Plaxo | 17,714 (5,419) | | 6 7,632 (303,148) | 8,174 |
| Proskore | 33,522 (3,997) | | 4 N/A | 29,209 |
| StartupNation | 29,126 (3,303) | | 6 45,132 (45,626) | 17,907 |
| Sunzu | 88,408 (3,111) | | 6 N/A | 197,394 |
| Viadeo | 1,083 (33,066) | | 6 30,891 (69,569) | 2,322 |
| XING | 606 (42,592) | | 9 19,806 (113,289) | 9,925 |
| Zoominfo | 2,079 (9,249) | | 6 751 (2,741,594) | 450 |
| BeKnown | 346,063 (362) | | 5 Low data | 40,912 |

| | | | | |
|---------------|-----------------|---|-----------------|-----------|
| BranchOut | 325,316 (728) | 0 | N/A | 232,687 |
| Upspring | 98,013 (928) | 3 | 28,773 (75,149) | 3,600 |
| ASCD Edge | 38,351 (4,559) | 5 | N/A | 23,289 |
| Classroom20 | 235,126 (1,312) | 6 | 87,692 (21,311) | 70,707 |
| Nurse Connect | 1,297,238 (86) | 2 | N/A | 1,221,065 |

Note. N/A: Not available.

4 Main Features and Functionality of PSNs

In this section, the main features and functionality of PSNs are identified. The information managed by PSNs concerning the worker can include: personal information, academic training, work experience, work competences and recommendations:

- Personal Information: surname and given name, gender, age, nationality, contact information, professional status, company, sector, city, adaptation needs, information concerning addresses.
- Academic training: official and non-official qualifications with date, knowledge and skills acquired on courses. Items such as degrees and institutions are taken into consideration here.
- Work experience: functions performed, companies, dates, durations, responsibilities.
- Work competences: languages, capacity to work in teams, ability to adapt to new environments and new cultures, leadership and communication abilities, availability to travel, availability to move house, availability to work online.
- Recommendations: references from co-workers, teachers and bosses regarding the user.

PSNs can store a wealth of user information which can be constantly updated. Companies can thus benefit from this information by analyzing worker profiles online in order to recruit personnel.

The functionality of PSNs can be grouped into four categories, as shown in Figure 4: communication and integration among PSNs, recommendation systems, and privacy and security. Communication is a means used by companies to develop their employer branding and to connect employees and future workers in PSNs [20]. Integration, privacy and security have been identified as desirable features in Web Based Social Networks [21]. Recommender systems based on social network analysis have been recognized as a useful tool with which to support human resources decision makers during recruitment [22].

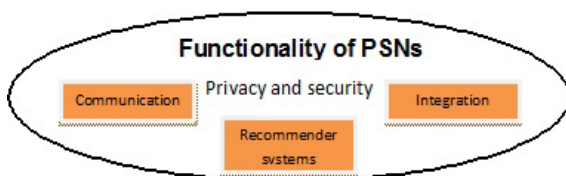


Figure 4 Main Functionality of PSNs

We have also developed a comparative framework based on the characteristics presented in Figure 4. This framework and its application to a subset of the PSNs studied are shown in Table 3. We have chosen the five most popular social networks according to Alexa, although we have excluded EURES since its number of users is lower than two million. In order to illustrate a wider variety of features, we have also included Beknown and Gremln because they have singular characteristics. Beknown is integrated into Facebook which implies millions of potential users, and it is maintained by Monsters.com, one of the largest job markets on the web. Gremln adds unique functionalities such as multi-language support and work team management, including the marketing department of the company. Its objective is to follow the marketing strategies efficiently by means of communication and cooperation between workers.

4.1 Communication

Company page refers to the possibility of creating a personalized profile of the company in which its main features are shown in such a way that workers can get to know the company and its job offers. This functionality is usually included in PSNs with a high number of users. The 'Groups' column indicates whether it is possible to create specific groups in order to discuss ideas or topics. Users can manage groups with different intentions: speaking about common business concerns, organizing workers with the same functions in the company, etc.

All of the PSNs analyzed in Table 3 permit communication between companies, and all of them except Infojobs permit communication between workers or friends. Users can collaborate in PSNs by sharing information contacts and work experience. PSNs incorporate a wide range of communication tools. Synchronous communication is achieved by means of tools such as chat systems, video communications or shared whiteboards, while asynchronous communication is achieved using email, newsgroups and mailing lists, workflow systems, group calendars and collaborative writing systems, among others.

4.2 Integration

To the best of our knowledge there is no integration among PSNs. A few PSNs allow users to join by using their LinkedIn account credentials. However, the situation is different as regards PSNs and social networks. Integration with other social networks is found in Beknown, Gremln, Infojobs, LinkedIn and Viadeo.

With regard to integration with other applications and services, email support must be highlighted. While other

external services such as social media analytics or Customer Relationship Management (CRM) utilities are only marginally offered by the PSNs under study, Outlook,

Gmail and other email tools and service providers are often supported.

Table 3 Comparison of PSN Functionality

| Characteristics | Beknown | Gremln | Infojobs | LinkedIn | XING | Viadeo |
|--------------------------------------|----------------------------------|--------------------------------|-----------------------|----------------------------------|--|-------------------------------------|
| Communication | | | | | | |
| Company page | No | Yes | No | Yes | Yes | Yes |
| Groups | Yes | Yes | No | Yes | Yes | Yes |
| Inter-companies | Yes | Yes | Yes | Yes | Yes | Yes |
| Inter-coworkers | Yes | Yes | No | Yes | Yes | Yes |
| Other users | Yes | No | No | Yes | Yes | Yes |
| Integration | | | | | | |
| Social Networks | Twitter, Youtube, Blog, Facebook | Facebook, Twitter, LinkedIn | Facebook | Facebook, Twitter, LinkedIn | No | Facebook, Twitter, Google+, Yahoo |
| Other applications | Yes. Gmail, Yahoo | Yes. Klout, Brev.is and Bit.ly | No | Yes. Outlook, Lotus, Bookmarklet | Yes. Lebenslauf.com, Acando CRM Connector, StellenWechsel.info | Yes. Outlook, Excel, Gmail, Hotmail |
| Recommender systems | | | | | | |
| Recruitment | No | No | Yes | Yes | Yes | Yes |
| Automatic course recommendation | No | No | Yes | No | No | No |
| Automatic job vacancy recommendation | Yes | No | Yes | Yes | Yes | Yes |
| Reputation | No | No | No | Yes | Yes | Yes |
| Privacy and security | TRUSTe. Privacy configuration | Permission configuration | Privacy configuration | TRUSTe. Privacy configuration | Privacy configuration | Privacy configuration |

4.3 Recommender Systems

The ‘Recommender systems’ column in Table 3 reflects whether the PSN includes an automatic system to help both applicants and recruiters in three ways: recruitment, course recommendations and job vacancy recommendation. All the information is usually provided by means of a list sorted by preference. ‘Recruitment’ indicates whether recruiters receive information about the best candidates for a job offer. PSNs thus allow companies to find adequate personnel by employing techniques such as job matching [23, 24], which the recommender system implements. Job matching consists of automatically linking a job offer with the list of candidates that best fits with the offer. For example, when a job offer is posted in LinkedIn, the system automatically seeks the best candidates. This process normally requires an automatic analysis of the worker’s CV using techniques such as Natural Language Processing (NLP) [25, 26]. Workers receive an alert (by email) indicating that an interesting offer has appeared, and recruiters receive the best qualified candidates for the job. Ontology-based and similarity-based formal techniques [27] have also been used. These methods have high precision but low

flexibility. Low flexibility refers to the difficulties involved in extracting similarity when a perfect match does not exist [28]. The ‘Course recommendations’ column indicates whether users receive a list of courses that will allow them to improve their CVs and adjust their professional profile to the current work context. For example, the European PSN Infojobs recommends courses to workers based on the requirements associated with a job vacancy. When users enter that job vacancy, the system suggests courses that will allow them to gain the professional competences required for the job vacancy. ‘Job vacancy recommendation’ indicates that users receive information about which jobs are most suitable for their professional profile.

Additional functionality such as contact recommendations [29] can also be found to extend workers’ and recruiters’ contact networks. Number of contacts, number of followers, contacts’ reputation or positive endorsements are factors which increase the user’s reputation. Reputation is a criterion used to identify experts [30].

4.4 Privacy and Security

Privacy and security are important issues as regards social networks [31]. PSN users are particularly concerned about their personal information being collected and used by third party applications [32]. To mitigate this problem, an approach called the collaborative privacy management system, suggested in literature, allows the creator of each resource to decide his/her own privacy policy [33]. The use of social networking also implies privacy and security issues as regards the sharing of information related to a specific company. Companies which use social media have to confront risks such as the loss of sensitive data, breaches of organizational confidentiality, breaches of organizational reputation and user misuse (malware, shared login, etc.), among others [34], which may damage the company's public image.

Security certificates can be used to ensure that the data contained in PSNs are protected. Users may feel more confident when using systems with security certificates, such as TRUSTe. The security certificates allow reliable communication to be established between two parties. Before starting communication, each interlocutor proves their identity by sending a credential, and the encryption protocol is decided. The interlocutors then exchange a private key that is used to encrypt all the information that will be sent. In addition to guaranteeing safer systems, companies and workers must also confront another problem which forces them to be alert: the increase in frauds via PSNs. This was the case of a fake financial adviser who was accused of trying to sell fraudulent securities valued at 500 billion dollars via posts on LinkedIn [35].

The Privacy Policies of the PSNs selected in Table 3 are shown in Table 4 by using a comparative framework defined in previous studies [36, 37]. Observe that all of PSNs have a user id and password as authentication systems. This is a serious problem since, according to the 2012 study by SICARA [34], 20% of social network users have experienced identity theft. In XING, Beknown, Infojobs and Viadeo users can grant access to their data, but only LinkedIn allows access to be granted to people who are not registered in it. For audit purposes, in LinkedIn, XING, Infojobs and Viadeo, users can see who has accessed their data. With regard to the information which is accessed without the user's explicit consent, we have found that most of the PSNs analyzed keep information related to its users' accesses. This information, which is usually related to how and from where the user accesses the PSN, is used to improve the PSNs' services. LinkedIn, Viadeo and BeKnown access information such as the user's IP, while XING, Gremln, Infojobs and BeKnown save the date and time of the user's accesses. Finally, LinkedIn, BeKnown, Gremln, Infojobs and Viadeo notify any changes to the Privacy Policy, but only LinkedIn, BeKnown, Gremln and Viadeo send the notice directly to the user.

5 Practical Advice for PSNs Users

5.1 Hints for Applicants

5.1.1 The Higher the Studies, the Better the Opportunities

Training and education are key factors in the labor market. PSN users should clearly describe and highlight their academic merits. PSNs provide a wide section dedicated to indicating the worker's academic training. All of the PSNs studied include a section of languages, degrees and courses. Other PSNs such as LinkedIn also allow candidates to introduce information related to PhDs or details related to research such as articles, conferences, excellence labels, etc. The rate of unemployment and non-temporary employment is much lower in the case of workers with a higher level of studies than those with just primary studies [38, 39]. In fact, three out of four jobs lost as a result of the current economic crisis only required primary studies [40]. Jobs in which more qualifications are required also have better salaries [41]. According to a recent study [9], on average, less-educated adults have the highest unemployment and inactivity rates and have the lowest and more rapidly declining wages throughout their working lives. In particular, over 80% of tertiary-educated people are employed in comparison with over 70% of people with an upper-secondary or post-secondary non-tertiary education and less than 60% of people with less than an upper-secondary education. Moreover, tertiary-educated younger adults have higher unemployment rates than tertiary-educated older adults: about 7% and 4%, respectively.

Nevertheless, since being overqualified can be an important problem [42-44], recruiters use recommendation systems to adjust the features of the worker's professional profile to a job vacancy. In order to facilitate this process, PSN users should introduce their academic achievements as accurately as possible, emphasizing the most positive aspects.

5.1.2 Behavior and First Impressions

Conway conducted a study [45] with a sample of 300 workers who were in charge of hiring personnel for their companies. This survey revealed that posting inappropriate comments, posting negative comments about a previous employer or attaching inappropriate photos have a negative impact on recruiters. Other aspects which are considered negative by recruiters while they are checking online profiles are posts of a sexual nature and spelling or grammar errors [46]. In fact, receiving messages with any kind of mistakes always causes a bad impression [47]. On the other hand, recruiters appreciate those candidates who belong to professional organizations (such as engineering associations, scientific journal registrations, etc.) or participate in volunteer associations, do charitable deeds or similar [48]. The characteristics associated with these candidates are leadership, initiative, good communication skills and the capacity to work in teams. Although neither PSNs nor the de facto standard Europass CV [49] include these intangible features regarding social relationships, applicants should indicate

organizations or causes in which they are involved in a PSN field.

5.1.3 Include a Picture in Your CV

What workers do not say in their CVs may have a greater influence than things they say [50]. Although there are different opinions about this issue, a study developed by Nicholas Salter and Tiffany Poepelman [51] reported that profiles with a picture have more chance of being selected for employment. Some recruiters perform a first selection by removing profiles without pictures. Including

a picture makes a worker appear more careful and thorough [4]. Furthermore, empirical studies [52] support the “what is beautiful is good” stereotype. Attractive job candidates are seen as more competent [53], receive more favorable hiring recommendations [54] and are perceived as being more highly qualified [55] than their less-attractive counterparts. These findings have been empirically confirmed in computer-mediated employment interviews [52].

Table 4 Comparison of the Privacy Policies of PSNs

| | BeKnown | Gremln | Infojobs | LinkedIn | XING | Viadeo |
|--|--|--|--|---|---|---|
| Privacy Policy Location | Link on Website Home. | Link on Website Home. | Link on Website Home. | Link on Website Home. | Link on Website Home. | Link on Website Home. |
| Data Management | Users can add, modify and remove their data. | Users can add, modify and remove their data. | Users can add, modify and remove their data. | Users can add, modify and remove their data. | Users can add, modify and remove their data. | Users can add, modify and remove their data. |
| Authentication | User ID and password. | User ID and password. | User ID and password. | User ID and password. | User ID and password. | User ID and password. |
| Cookies | Yes | Yes | Yes | Yes | Yes | Yes |
| Access Management | User can grant access to other Beknown users. | A user profile can be accessed by Gremln employees. | A user profile can only be accessed by registered companies or teaching centers. | User can grant access to other LinkedIn users and non-LinkedIn users. | User can grant access to other XING users. | User can grant access to other Viadeo users. |
| Access Audit | Not indicated. | Not indicated. | Users can see who has viewed their profile. | Users can see who has viewed their profile. | Users can see who has viewed their profile. | Users can see who has viewed their profile. |
| Data accessed without the user's permission | BeKnown saves information about user's accesses, such as services accessed, IP, browser and operating system type, geolocation and access times. | Gremln saves information about users' accesses, such as date, time, browser and operating system type. | Infojobs saves information about users' accesses, like date of first and last access, navigator used, etc. | LinkedIn accesses information related to users' accesses (such as IP, browser and operating system type). | XING saves information about users' accesses, like date and time. | Viadeo accesses information related to users' accesses (such as IP) and to ensure compliance with the safe harbor principles. |
| Changes Management / Notification in Privacy Policy | Notification on Website and by email. | Notification on Website and by email. | Notification on Website. | Notification on Website and by email. | Not indicated. | Notification on Website and by email. |

Note. “Not indicated” represents that some information is not specified in the privacy policy.

5.1.4 Be Open to Mobility

Going abroad allows workers to learn new languages and discover new cultures, which is highly appreciated by companies everywhere. Concretely, knowing the language of the country where you want to work is essential if you wish to obtain a job [56]. Both studying and working

abroad increase the probability of finding jobs in different countries [57, 58] and international experience entails better opportunities. Mobility is especially important for early-career employees since they can earn higher salaries [59].

Some PSNs such as Infojobs allow users to indicate labor mobility and how far a worker would be prepared to travel. Since mobility can be deduced from the workers' background, PSN profiles should include national and international experience. In the near future, recommender systems will incorporate heuristics to predict whether certain workers are willing to move to another town for employment purposes.

5.1.5 Improve Statistics Regarding Access to Your Profile

Recruiters very often check the online profiles of workers who apply for jobs at their companies. Workers are therefore interested in improving their statistics and checking who has visited their profile. This information reflects how popular and attractive a profile is. Adding PSN profiles to your email signature, posting a new job or internship, interesting articles or quotes once or twice per week, are means of improving the visibility of your profile. Users' PSN profiles usually have more visitors from other users than their contact list. According to a survey performed in Facebook the contact list of a user has: 22% people from high school, 12% extended family and 10% co-workers [60]. Workers' profiles can thus be promoted by using the contact list.

5.1.6 Build a Wide Network of Contacts

PSN profiles provide a means for workers to contact recruiters who may know of job vacancies, or can simply introduce them to the mother recruiters or interesting people. One empirical study in particular has shown that expanding your social ties with co-workers and employers can also help you find a job since more work-oriented updates are received [61]. In fact, making contacts is one of the best ways to look for a job. Having more contacts and relationships therefore improves the possibilities of finding a job for three main reasons [62]:

- People prefer to hire or do business with other people that they know or like.
- Being in touch with people related to a job offer means being in a smaller group of recommended applicants.
- Many job offers are not advertised at all, signifying that there is less rivalry for the job.

The time a person spends on PSN networking is positively related to the possibility of finding job offers [63]. PSNs provide workers with the opportunity to build up a wide network of contacts. In fact, PSNs encourage users to achieve a network of contacts that is as wide as possible. For example, Facebook manages a contact model based on the theory of six degrees of separation. According to this theory, any two people are connected through a chain six or less individuals [64]. Empirical studies in social networks have proven this theory [65]. LinkedIn proposes a similar model but with three degrees of separation. LinkedIn invites users to increase the number of first degree contacts by proposing other first level contacts of first, second or third degree contacts.

5.1.7 Participate in Related Groups

As indicated in Table 1, some PSNs allow workers to participate in groups. Groups represent a good opportunity for workers to show their profiles and spread them to

people who share their interests. Applicants and workers in the groups find a tool to increase their visibility and an open forum in which to maintain technical discussions about specific topics and exchange ideas. For example, a computer engineer might be interested in joining an IT related group so that people working in that field and potential recruiters will know about his/her skills, experiences and abilities. Likewise, recruiters use groups to meet potential candidates. LinkedIn has 2 million groups, 14,000 of which are related to recruitment, whereas XING has more than 50,000 groups, 3,350 of which are devoted to jobs and careers.

5.1.8 Keep Scammers in Mind

Scammers are gaining importance given the amount of people and personal data gathered in PSNs. Identity theft is one of the most important problems caused by scammers. Users in PSNs are prompted to include personal data to perform certain operations (e.g. password of an email account in order to verify an email account or to recommend that a co-worker joins a PSN). In phishing attacks, scammers send users emails which include (usually as a link) a replica of the authentic PSN web. This fraudulent site is used to harvest the personal information provided by the victims. Related literature has reported that maintaining a CV online puts job seekers in danger of becoming identity-theft victims [66]. Some protection measures against scammers are: do not give the date of birth but only the age, and avoid introducing addresses or social security numbers if they are not absolutely necessary. In addition, PSNs should adopt preventive measures to avoid phishing. For example, showing warning messages to alert users to scammers and displaying personalized images next to password prompts can be effective in protecting an identity from being disclosed [67].

5.2 Hints for Recruiters

5.2.1 Bear Quality and Overqualification in Mind

A study performed by Jobvite [4] revealed that the candidates found through PSNs have more quality (a higher level of studies, more experience and better matching to the job requirements). Note that quality is not always accompanied by high qualifications. Overqualification is a problem with consequences such as lack of motivation and low performance at work. The commitment acquired with the company is directly related to the workers' motivation [68]. The perception of quality can also be influenced by posting information on the worker's personal page. Messages about family orientation and professional orientation have a significant influence on recruiters [69].

5.2.2 Use Techniques to Attract Passive Candidates

A significant amount of the people registered in PSNs (69%) are not unemployed [4]. These people are called passive candidates, that is, workers who expect to improve their current work situation but are not actively seeking a new job. Passive candidates are usually qualified workers with sufficient experience to do a job. Passive candidates are more likely to want to make an impact, to want challenging work, to want a corporate culture that fits their

personality and are less likely to need skill development [70]. Companies try to identify and attract the best qualified and experienced people in order to win the battle against their competition [71]. Employers are therefore very interested in finding the best passive skilled workers through PSNs [72].

PSNs know about the importance of passive candidates for recruiters and thus have a lot of advanced services that are devoted to attracting and hiring passive candidates. For example, LinkedIn has an internal email called Inmail with which to contact candidates, which is, according to LinkedIn statistics, answered in 50% of cases. This tool allows recruiters to manage a pipeline of talents, to organize the candidates by folders, to synchronize team activities in shared projects, and to search for the company in which a worker works. A Session Analysis of People Search is used in PSNs to predict and anticipate the results of the search for both companies and workers [73, 74].

We recommend certain strategies and techniques that can be used to increase the likelihood of a successful hiring process. Firstly, a clear idea is required of the qualified candidates needed for the company currently and in the future. A checklist containing the best places to seek and type of advertisements to be posted should then be prepared. Recruiters should offer a career, not only a job. Passive candidates will accept changing their job only to progress in their career. The techniques most frequently used by recruiters to attract passive candidates are better salaries and more flexible work conditions [4, 75]. Finally, companies should advertise each job offer correctly by using PSNs [76], complemented with other digital means to explain and promote the features of a company such as e-cards, virtual open houses, podcasting, blogging, social networking or search engine optimization [77].

5.2.3 Consider Particular Characteristics of Young People

According to studies performed in PSNs [42], there is a special type of applicants with particular characteristics: users aged less than 29 who are considered to be young people. This group should be taken into account by recruiters in PSNs. Young people have a lot of problems finding jobs after completing their university studies, usually under temporary contracts [78] with low salaries [79] and high vulnerability to losing their jobs [80]. These working conditions, along with being overeducated to perform a job, are a problem for companies because dissatisfied young workers can leave their jobs in a short period of time [81]. Although work experience is always appreciated, with regard to young people, it may be even more important to consider qualities such as responsibility, desire to learn and potential to become a good worker.

5.2.4 Company Page in PSNs

A company page in a PSN has important benefits: exposure of products, exchange of ideas and engagement of followers, among others. Professionals can discover new company strategies, job opportunities, and research products and services. As an example of its commercial importance, almost 4 million business companies have a company page in LinkedIn. Company pages should be endowed with recruiting-oriented style and content based

on a careful analysis of the needs and motivation of the target labor market subpopulation [82]. Interactivity, vividness, and information richness are website design issues which have an effect on job advertising outcomes [3]. Usability and the quality of the company page also have an impact on recruitment [83].

PSNs additionally allow recruiters to locate job offers in places devoted to PSN publicity. Viadeo also establishes site usage criteria that can be used to choose which users will receive companies' advertisements. This means that recruiters can filter the candidates depending on their activity in the PSN: interests, contacts, participation in groups, etc.

5.2.5 Improve Your Statistics in PSNs

Empirical results have demonstrated that reputation has positive effects on brand performance [84]: customers tend to buy company products or services, thus enhancing the corporate reputation of suppliers. Recruitment can be considered as job marketing. Companies should therefore use their corporate reputation in PSNs and achieve a good position in social media in order to attract the best job applicants. The company's reputation can be improved by (1) increasing the number of followers, (2) maintaining a good relationship with its followers, (3) getting followers to share the company page content, (4) publishing relevant information and insights related to the area of expertise on the company webpage.

Some PSNs also allow workers and companies to check profiles everywhere by using mobile applications. In fact, 27% of LinkedIn users visited this PSN via a mobile device in 2012 [85]. The content generated by companies on PSN websites should therefore be adapted to mobile devices in order to improve their visibility, thus increasing their popularity. Context awareness could be a differentiated feature of a PSN mobile application [86] in such a way that context information (e.g. location) can be used to automatically provide workers with job offers [87].

6 Open Issues and Future Directions

In this section, a number of issues that have not been fully resolved are presented, along with future directions for the progress of PSNs. The ideas are organized in the four functionality categories presented earlier.

6.1 Communication

Company pages and groups are used to enable communication between workers and to make contact between workers and companies possible. In particular, groups are not complex features from the technical point of view, but in contrast, they represent a relevant concept. A person's sentiment towards a given issue is influenced by those of his or her neighbors, so that people who share the same sentiments have a strong likelihood of falling into the same group [88]. However, it is worth to note that only 7 of the 21 PSNs identified in our study (Table 1) include both company pages and groups: Zoominfo, E.Factor, SunZu and 4 of the PSNs presented in Table 3 (Gremln, LinkedIn, XING and Viadeo). PSNs which allow only the creation of groups are: Beknown, Ascdedge, Classroom20

PerfectBusiness and Startupnation, whereas Upspring only includes a company page.

Education in virtual environments such as PSNs has gained popularity in recent years, given that they are the most popular technologies among students [89]. These spaces can be efficiently utilized for teaching purposes in order to take advantage of the educational potentials of popular PSNs. For instance, it is possible to use typical social network service platforms for seamless interaction between students and their professor [90] and for knowledge sharing and contribution [91].

6.2 Integration

Interoperability of resources in PSNs is an important issue, since someone seeking a job should currently introduce and update their information in several PSNs, which may lead to inconsistency problems. However, we have not found any standards for the representation of professional data, only those that allow the definition of competences in the e-learning domain, such as IEEE Simple Reusable Competency Map (SRCM) [92]. In Europe, the de facto standard Europass CV [49], which can be completed in 26 different languages, allows people to detail their qualifications and skills in a straightforward and understandable manner. Nevertheless, structures with which to represent professional data in a common manner have been proposed. This is the case of the ontology called resume RDF, developed by the National University of Ireland [93]. This ontology is able to express CV information regarding a worker, such as personal information, academic training, skills, etc., on the semantic web. Interoperability among PSNs could be achieved by means of a common ontology.

Most PSNs came into being with commercial objectives and may not therefore have any interest in sharing information, particularly if a PSN is already well positioned in the market. In this case, an alternative approach would be to develop third-party software that is capable of converting profiles into the different formats that each PSN uses. Matching different profiles to create a global profile which provides a holistic view of an individual's professional data is also an alternative solution [94].

6.3 Recommender Systems

Recommender systems are not a new concept; there are many recommendation schemes to provide users with the most relevant information in various domains [95, 96]. In this sense, in an increasingly globalized world, none of the PSNs under study incorporate recommender systems based on behavior and cultural aspects [88], which may be crucial if the duties of a job are to be performed efficiently and effectively in an international context in which mobility is increasingly more important [97]. Cultural aspects such as language, attitudes toward authority, cultural norms of social behavior, religion or customs must be considered owing to their influence on the way in which people behave, understand ideas, build up relationships and therefore work [98, 99].

Since many social networking services have emerged, they have enabled users to share and exchange their personal opinions [100]. Social networking services' users are likely to express their emotional status to let other users know how they feel about certain events. Sentiment analysis (also known as opinion mining) can be used to identify and extract subjective information in social media data to uncover hidden facts or issues by analyzing social relationships and reciprocated messages between users [101]. As regards PSNs, the sentiments and opinions can be harvested and analyzed automatically to provide additional insight into PSNs' stakeholders [102]. This information cannot be easily obtained by other means (e.g., psycho-technical tests, personal interviews), and might be useful to identify suitable targets (posts, courses, workers).

6.4 Privacy and Security

The international regulation of data protection in PSNs is a vital issue if the problem of privacy of information as a result of the use of new technologies on the Internet is to be confronted. This is particularly important in cloud storage [103, 104], where data is stored on servers hosted by third parties in different countries. The main contractual features such as jurisdiction, liability, service levels or acceptable use are challenging issues. All the countries in the European Union have developed personal data protection laws based on the European directive 95/46/CE of 1995 [105]. The Directive 95/46/EC has the objectives of ensuring the fundamental rights and freedom of citizens when their personal data is processed and the free movement of such data. The directive 2002/58/EC particularizes and complements the Directive 95/46/EC by protecting the processing of personal data and ensuring privacy in the electronic communications sector. This directive is especially important as regards PSNs in which personal data is managed and shared by means of electronic communication. A new draft legislative package to establish a unified European data protection law, which is also applied to all US companies that process European residents' data, was recently announced by the European Commission. In the United States, the focus is "sectorial" and is based upon various laws and regulations. The right to privacy of information in the US is guaranteed by laws such as The Privacy Act of 1974 (<http://dpcl.o.defense.gov/privacy/documents/pa1974.pdf>), the Fair Credit Reporting Act of 1970 (<http://www.ftc.gov/os/statutes/031224fcra.pdf>), or the Electronic Communications Privacy Act of 1986 [106]. The organism responsible for regulating the transfer of personal data between the European Union and the United States is the Federal Trade Commission, which depends on the United States Department of Commerce. Other countries such as Canada, Malaysia, Japan, and many in Latin America, have also developed their own legislation, thus revealing the global concern of governments with regard to this issue [107].

7 Conclusion

PSNs have millions of registered users. PSNs are changing the way in which jobs are sought and personnel are hired. For candidates, PSNs is a means to exhibit their CVs to an enormous audience of recruiters and participate in more selection processes. For recruiters, the amount of candidates with high qualifications is greater. Recruitment in PSNs is increasingly more important owing to their evolution, with thousands of new registered members every day. In the PSNs studied, such as LinkedIn or Viadeo, the amount of people is so huge that each selection process has more candidates than any face to face process [108]. PSNs save time and money, with more dynamic candidate-selection processes in which many tasks can be automated. According to a recent survey performed by Jobvite [4], 89% of companies hired someone through LinkedIn in 2012, while 26% used Facebook and 15% used Twitter. Moreover, candidate profiles can be accessed and checked from anywhere using the Internet and mobile applications.

In this study, a detailed analysis of 21 popular PSNs was carried out. Firstly, the PSNs were gathered by means of a literature review that followed the PRISMA statement. The information sources included articles from scientific libraries (i.e., ACM Digital Library, IEEE Xplore Digital Library and Science Direct) and the Internet in order to complete the information available. The searches took place during three months (September-November 2014). Moreover, the data collection process was performed by: (1) analyzing documents regarding use policies, privacy and security policies and functionality; (2) examining the PSN websites; and (3) studying the information presented in each professional profile.

Secondly, a descriptive analysis of the selected PSNs was performed, paying special attention to their main figures, evolution and popularity. In this regard, LinkedIn dominates professional networking. LinkedIn is the largest PSN in the world, with more than 300 million people, and an annual growth of 38 percent. Moreover, LinkedIn accounts for 64% of all visits from social media channels to corporate websites, and has 1.45 million job views and 44,000 job applications via mobile devices [109]. LinkedIn recently opened up a publishing platform to allow members to include posts published on LinkedIn in their professional profile.

Thirdly, the main features and functionality of PSNs were identified. The functionality of PSNs was grouped into four categories, namely: communication and integration among PSNs, recommendation systems, and privacy and security. According to our study, it must be emphasized the need for integration among PSNs. A common standard with which to represent workers' professional data would allow users to maintain multiple coherent profiles in several PSNs.

Fourthly, we elaborate on the recommendation systems category mentioned above. In the light of our study, the improvement of recommendation systems can boost the possibilities of PSNs. In this sense, new metrics such as cultural aspects, behavior [110] and personality

should be measured and considered in PSNs in order to select candidates effectively and automatically. Personality traits are related to job performance and can be used in pre-employment testing [111, 112].

Finally, some recommendations are provided to the readers based on our analysis of PSNs, which are aimed at improving the perceived benefits for both applicants and recruiters when using PSNs. This is motivated by the fact that PSNs are powerful tools, but they should be used in a proper way in order to get the most of them.

In future work, PSN personal health information (e.g. disabilities) may be integrated into PSNs [36]. On the one hand, candidates could be selected preferentially by using a quota system for the employment of disabled individuals, included in some national employment legislation. On the other hand, recruiters could benefit from financial incentives, fiscal benefits, disability awareness and corporate social responsibility, among others. Nevertheless, given the sensitivity of health-related information [113], workers should give consent to the use of their personal health data. Moreover, privacy and security standards or regulations in the early stages of PSN development should be used to achieve safer PSNs. These standards or regulations could also be used as the basis of a checklist for audit purposes [114, 115].

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