Chapter 8
Future ICTs: Present Trends for Future Developments

Abstract This chapter addresses Future ICTs, covering present trends and future developments. It is divided into two main sections: Social networks trends and Web 3.0 trends. Social Networks trends will detail aspects like the anonymity and privacy debate, Business, Education and other sectors. Web 3.0 trends will cover aspects like the semantic heterogeneity challenge, Business, Education and other sectors.

8.1 Social Networks Trends

This section addresses key trends regarding Social Networks (SNs), organized by broad categories, as depicted in Fig. 8.1 below.

In Table 8.1, it can be summarized some of the key trends detailed in the following sections.

8.1.1 The Anonymity and Privacy Debate

Some online social networks impose a real-name policy which prevents their users from using alias. This policy is justified by the social networks as a strategy to improve content and service, to facilitate users' search for contacts and to enable accountability. Despite the benefits that social networks often numerate to explain the adoption of this policy, there is a growing controversy associated with the use of the user's real identity. By requesting their users to register with their real identity, these platforms have access to information that jeopardizes privacy and online freedom (Peddinti et al. 2014). Users who are concerned with their privacy have found means to circumvent this policy. Also, some social networks, such as Twitter, do not condition users' registration to the use of their real identity (Peddinti et al. 2014).

The growth of health related social networks has raised issues of privacy for their users. While it has become known that the participation of patients in online platforms for health issues can represent an assortment of benefits, it can also pose a challenge in terms of the protection of the users' privacy. The authors developed a model that depicts the patients' information sharing behaviour based on three

T. Issa, P. Isaias, *Sustainable Design*, DOI 10.1007/978-1-4471-6753-2_8

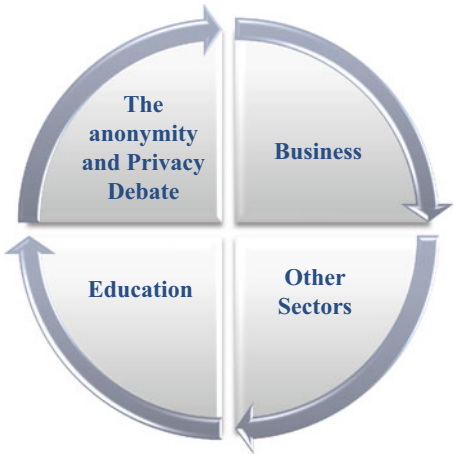

Fig. 8.1 Social networks broad categories of key trends (Prepared by Pedro Isaias)

Table 8.1 Networks key trends (Prepared by Pedro Isaias)

Anonimity and privacy debate trends	**Business in SNs trends**
Alias vs. real-name policy	SN sites in business must follow specific guidelines
Volume of information vs. users privacy	Online SN presence fosters business relationships (both on-line as well as off-line)
Higher number of SN users – anonymity vs. de- anonymisation	SNs constitute great communication challenges
Transparency and the right to be forgotten	Key users roles in SNs is crucial
	SNs empower clients
Education in SNs trends	**Other sectors in SNs trends**
Distraction vs. positive role of SNs in Education	Health sector focus
Gender role of SNs in education	Social graph analyses
Mobile SNs usage	Sampling methods for SNs
	Citizen participation

factors: individual characteristics, type of information and breadth of the audience. Patients seem to prefer moderate platforms that offer protection to their private information, but facilitates the exchange of clinical data (Frost et al. 2014). This model provides insight into important patterns of information sharing, which can help to improve the design of online communities.

The rising number of social network users causes great volumes of varied information to be posted online. This volume of information is in its turn responsible for the growing availability of datasets via the internet. Although users attempt to anonymise their information, it is becoming increasingly uncertain if their data is protected from de-anonymisation. In light of this predicament, transparency is rising as a new framework for information management. In addition to transparency, the right to be

forgotten is vital in information management in the sense that it would allow users to delete previous data, when introducing new information (Kataoka et al. 2014).

Transparency has the potential to endow social network users with the sense of increased control. This perception of control can have a positive impact on the effectiveness of online advertising in social networks (Tucker 2014).

In order to improve their users' sense of privacy, Facebook is one of the social networks that is investing in the development of technology to empower users to determine exactly what information they want to make available to the public and what data they prefer to withhold (Tucker 2014).

8.1.2 Business Issues

The successful deployment of social network sites in the business arena should follow specific guidelines. Moreover it is crucial to use measurable criteria to assess the actual effects of the use of online social networks in terms of revenue (Isaías et al. 2012a).

The participation on web based social networks has repercussions on the users' business relationships. It is believed that individuals with online social network presence have more opportunities to connect and strengthen ties with other professionals. Despite being hosted online, web based social networks are facilitating offline relationships (Benson et al. 2014). It is important that in the future, research approaches the connection between social network participation, professional communities' affiliations and the acquisition of workplace and career competences (Benson et al. 2014).

Social networks are excellent communication channels with unlimited audience reach and information dissemination. When examining the dynamic of event organisation, for example, it is possible to understand the important role that social networks play in event promotion. Organisers can use social networks as vehicles of information. In the case of music festivals, there is a significant amount of data that can be disseminated through social networks (performers, schedules, etc.) to those attending or wishing to attend the event. Additionally, the engagement of people in social networks is potentially beneficial in terms of building the attendees' loyalty to the event and again in terms of marketing the event with personal statements (text, photos, etc.) provided by the attendees (Hudson et al. 2015).

Within online social networks, there are members that work as "influential". These members can be very valuable for businesses due to their word-of-mouth power and their status of role models. They can reach their contacts more proficiently, which causes them to swiftly and widely disseminate information and by acting as role models, the other members are likely to be motivated to mimic them. The identification of these key users has become a central issue for business, so much so, that the strategies to make that identification have more recently become a significant research topic (Klein et al. 2015).

Online social networks have an important role in the empowerment of clients. They are interactive platforms that allow users to generate content, search for information and express their opinions about different products and brands. Internet

users are sometimes called digital evangelists for their influential role among social networks, which can cause a product to proliferate or fail. Also, they are often denominated prosumers for their part in companies' creative process, via the suggestion of new products or services (Gonzalez et al. 2015).

8.1.3 Education Issues

Social networks can be used for formal or informal education (Teoh et al. 2014). The claims that online social network participation has a positive impact on students learning have been the focus of much research efforts (Thelwall and Kousha 2014; Park et al. 2014; Lawler and Molluzzo 2010; Vie 2008).

Social networks use in education remains a subject of interest due to their extensive reach, to the frequency and intensity with which they are used and their promising educational value (Park et al. 2014). Although there is research arguing that social networks mainly work as a distraction, there are also studies that attest to their positive role in enhancing communication and the relationship that students develop with teachers (Teoh et al. 2014) (Isaías et al. 2009). On the other hand, when social networks are used for intimidation or unwanted contacts, students can feel that these platforms are a mere extension of the challenges that they already face offline (Isaias et al. 2013a).

More recently, research is focusing on different aspects of social network use in education in order to potentiate its value. Teoh et al. (2014), for example, studied the role that gender plays in social network usage for learning. The authors concluded that male students are more prone to perceiving social networks as important pedagogical tools, than female students. This information, regardless of the limitations of the study, can be determinant for the implementation of social networks in classes with significant gender differences.

Social networks are being used in the education sector, but education is also being used in the online social networks arena. The increase of children and teenage users on social networks has lead to the preparation of several educational packages that promote a more secure participation on these platforms (Vanderhoven et al. 2014).

An important trend in the application of social networks in education is the creation of Mobile Social Network Sites (MSNS) for educational purposes. The iniquitousness use of social networks facilitated by mobile devices has created the notion of MSNS (Wang and Du 2014).

8.1.4 Other Sectors

The health sector has been focusing on the value that online social networks can represent for this area. Health entities' profiles on these platforms constitute an improvement in terms of their accessibility. Additionally, social networks can assist patients in the management of their pathologies. Their contribution to the collection of important data is also under scrutiny. On the one hand they are sources of unlimited and rich data, but on the other hand they pose reliability and bias challenges.

Moving forward, it is fundamental that research focuses on examining strategies to effectively use them as data sources (Alshaikh et al. 2014).

The health sector has an important preventative role, which relies greatly on the use of media to reach extensive audiences with health campaigns and awareness initiatives. Besides resorting to traditional media, the health sector has been investing in the use of internet media, namely the use of social networks. The recent interest in the use of online social networks to convey health information is based on their extensive reach, on the fact that the information can be transmitted to existing contacts, on their capacity for high engagement and retention levels, and on their interactive nature. The use of social networks to promote behavioural changes in terms of health is in a embryonic stage, but in the future research is expected to gain more insight into the actual benefits of these platforms for long term behaviour transformation (Maher et al. 2014).

Although web based social networks are being used for the purpose of social graphs analysis for quite some time, more recently, they are posing several challenges. Online social networks are growing in size, reach, complexity and data protection procedures. These changes are demanding advanced techniques for social graphs analysis. More specifically, this evolution of online social networks' characteristics have hindered sampling processes (Haralabopoulos and Anagnostopoulos 2013). The millions of users that compose online social networks pose a challenge in terms of its analysis as a whole. The search for a method that can produce a representative sample usually results into three types of graph sampling techniques: by random node selection, by random edge selection and by exploration. Nonetheless, these methods are incapable of creating a sample that can replicate the characteristics of an original graph (Yoon et al. 2015).

Haralabopoulos and Anagnostopoulos (2013) argue that different sampling techniques should be used in different situations to improve the identification of social network ties. In situations where the sampling size is small, Conventional Random Node Sampling should be used; in cases where larger samples are required, Enhanced Random Node Sampling is better suited. Yoon et al. (2015), on the hand, developed a sampling method that uses hierarchical community extraction and densification power law. By using these two techniques, the sampling method is able to generate sample graphs that reflect both the node-edge ratio and the topology of each region and of the entirety of the original graph. Additionally, subject recommended sampling techniques, such as snowball sampling, are also appropriate methods to assist the research of social networks (Isaías et al. 2013b).

Social networks, such as Facebook, have the potential to reach unlimited numbers of users, making them important resources for citizen participation and the promotion of causes and campaigns (Isaías et al. 2012b).

8.2 Web 3.0 Trends

This section addresses key Web 3.0 trends regarding Social Networks (SNs), organized by broad categories, as depicted in Fig. 8.2 below.

In Table 8.2, it can be summarized some of the Web 3.0 key trends detailed in the following sections.

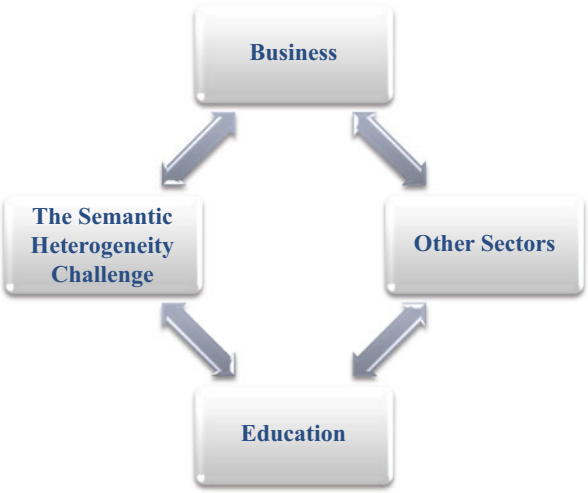

Fig. 8.2 Social networks broad categories of Web 3.0 key trends (Prepared by Pedro Isaias)

Table 8.2 Social networks web 3.0 key trends (Prepared by Pedro Isaias)

The semantic heterogeneity challenge	**Business in SNs trends**
Ontologies' definitions	Marketing Web 3.0
Data integration	Filtering possibilities
Semantic heterogeneity	E-commerce role
Semantic interoperability	Decision Support Systems (DSSs)
	Data integration
Education in SNs trends	**Other sectors in SNs trends**
Personalized learning objects	Social media and masses of information
Role in medical education	Ontologies and the tourism sector
Web 3.0 in MOOCs	Biomedical research
	e-Government
	Weather forecasting

8.2.1 The Semantic Heterogeneity Challenge

The overwhelming amount of information available online means that users can have access to unlimited sources of data, however that does not necessarily mean that data is more accessible. The volume of information available on the internet seems to be varying proportionally to the difficulty of extracting meaning from it. For this reason the Semantic Web aims to semantically interpret existing online data (Rana and Singh 2014). The fundamental concept of Web 3.0 is machine-understandable data. Hence, Web 3.0 has the challenging mission of adding meaning to online resources, through the definition of ontologies. This mission is

particularly complex due to the fact that the Web has an open nature and as such "online semantics can be defined by different people, for different domains, and can vary significantly in expressiveness, richness, coverage, and quality, leading to increasing semantic heterogeneity." (Gracia and Mena 2012). When discussing the implications of semantic heterogeneity for the financial sector Li et al. (2014) refer to the creation of a "data *Tower of Babel*", which provides a clear illustration of the challenge of heterogeneity. Thus, semantic heterogeneity also poses a challenge for data integration (Jing 2015).

Both semantic ambiguity (different meanings for the same word) and semantic redundancy (different words for the same meaning) constitute an obstacle to the successful deployment of Semantic Web technologies. Semantic heterogeneity hinders the interoperability that is expected from Web 3.0 and despite the fact that this issue is addressed in specific domains and systems, there are only scarce solutions for dealing with it on a global scale (Gracia and Mena 2012).

In situations where applications are using competing ontologies their capacity to interoperate becomes compromised. Ontology matching is often used to address this issue (Shvaiko and Euzenat 2013), as it is regarded as one of the solutions to facilitate semantic interoperability. It consists in establishing a correspondence between similar semantic representations in ontologies (Rana and Singh 2014). There is a variety of matching systems such as SAMBO, Falcon, DSsim, RiMon, ASMOV, Anchor-Flood and AgreementMaker (Shvaiko and Euzenat 2013).

Maree and Belkhatir (2015) divide the different approaches to ontology alignment into three groups based on single-strategy, multiple-strategy and the exploitation of external semantic resources. The authors propose an alternative to these approaches by developing a framework that merges domain-specific ontologies using numerous external semantic assets (Maree and Belkhatir 2015).

As, an alternative to ontology matching Zadeh and Reformat (2013) presented a technique to identify semantic similarity that emphasises the relation between the terms and their semantics. This technique enables an evaluation of context-aware similarity and of specific segments of information that are part of the terms.

Data integration refers to the integration of data deriving from several sources and it can be used to solve semantic heterogeneity. Data integration has three approaches: data consolidation, data propagation and data federation. In addition, data integration can also use ontology to address heterogeneity. SIMS, OBSERVER, DOME, KRAFT, COIN are just some of the various systems that use ontology for this purpose (Sowmya Devi et al. 2014).

8.2.2 Business Issues

The concept of Enterprise 3.0 is becoming increasingly popular and it uses Web 3.0 as a platform (Ahrens and Zaščerinska 2014). Additionally, Marketing 3.0 has emerged, partly, due to changes in the behaviour of consumers. Clients have ambitions of a more collaborative and cultural marketing (Erragcha and Romdhane 2014).

This 3.0 version of marketing is based on the relationship between several actors, namely consumers, enterprises and sponsors. Clients have become increasingly creative and able to act as co-inventors of products. Additionally, globalization has made people value their culture, thus placing cultural matters in the list of priorities of commercial brands (Erragcha and Romdhane 2014).

With its constant evolution, the internet has supplied businesses with different type of information. In its primordial stage, Web 1.0, delivered information about products; Web 2.0, in its turn allowed insight into the customers' viewpoints; Web 3.0 uses all that information and transforms it into knowledge. The flow of information available hinders management decision making. Hence, Web 3.0 offers filtering possibilities and the opportunity and means to sort through the unlimited amounts of data. E-commerce is also an area where Web 3.0 can have a significant role. The semantic web can endow e-commerce businesses with features that will tailor the purchasing experience according to the clients' needs and characteristics, namely by using geo-referencing and client profile's data (Almeida et al. 2013).

Decision Support Systems (DDS) have been taking advantage of the features of Web 3.0 for the past decade. The Semantic Web can be applied to DDSs to assist several processes, namely, the integration and exchange of data, "web service annotation and discovery, and knowledge representation and reasoning." (Blomqvist 2014). Data integration is one of the major challenges of DDSs. By using Web 3.0 for data integration purposes, it is also possible to improve research, since more data is linked. Despite all of the advantages that Web 3.0 can represent in terms of DDSs, the scalability of the Semantic Web and its lack of maturity in optimisation and efficiency, which other more conventional methods of data management do offer (Blomqvist 2014).

8.2.3 Education Issues

While much debate exists still on the use of Web 2.0 in education, a more current discussion is the progressive use of Web 3.0 as an educational tool. The widespread use of the term e-Learning 3.0 is one of the indicators of Web 3.0's impact in education. The specific characteristics of Web 3.0 allow this version of the Web to afford nor only personalization, but also information management and semantic enrichment. The challenge for the future in terms of Web 3.0's deployment in education is the concrete steps that educators and students will take to incorporate it in their practices and routines (Miranda et al. 2014b).

Web 3.0 has become a resourceful enabler of personalized Learning Objects and Virtual Learning Environments (Kurilovas et al. 2014). It is, moreover, associated with the concepts of big data, cloud computing, augmented reality and 3D visualization, personal agents and with linked data (Dominic et al. 2014). The close relationship, between the Semantic Web and Artificial Intelligence, promises to endow the education sector with the capability to manage

a great volume of data, since Artificial intelligence is a powerful tool for exporting meaning and patterns in data (Dominic et al. 2014). The unlimited sources and volumes of data available on the internet hinder its adequate use and application. The Semantic Web offers a solution by investing in sorting and categorizing information (Jiang 2014). Content is classified, structured, and endowed with specific annotations that enable its comprehension by machines. The use of ontologies attributes meaning to content and allows it to be exchanged and reused (Vera et al. 2013).

Medical education uses virtual patients to improve students' learning process, but their use across different systems can be very challenging. The authors developed a system (OpenLabyrinth) using the Semantic Web, that enables virtual patients' sharing and resource repurposing. This use of semantic annotation is becoming very important in repurposing content (Dafli et al. 2015).

The Semantic Web introduces new technologies and methods to link, edit and present information (Powell et al. 2012). Web 3.0 is also being used in MOOCs as a technological support for enhanced cooperation and communication (Waßmann et al. 2014). Furthermore, by the interaction and communication that takes place in learning environments can be used to tailor a more personalised learning experience (Halimi et al. 2014).

Moving forward in its role in education, Web 3.0 will have to address its interoperability challenges and also the issues deriving from ontology creation (Miranda et al. 2014a). Furthermore, Web 3.0 comes with additional security and privacy concerns (Dominic et al. 2014).

8.2.4 Other Sectors

According to Bontcheva and Rout (2014) "social media streams pose a number of new challenges, due to their large-scale, short, noisy, context-dependent, and dynamic nature." The colossal amount of information that is generated by social media can no longer be addressed by conventional search approaches. The Semantic Web is being regarded as an alternative to the conventional methods in the sense that it can assist user to manage the overload of data that originates from social media. The use of automatic semantic-based methods can be beneficial for both data interpretation and decision making processes of media streams, by being able to adjust to the users' information search objectives (Bontcheva and Rout 2014).

The use of ontologies within the tourism sector has the potential to minimize the detrimental effect of different depictions of tourist locations. By using ontologies it is possible to create a structured foundation of common depictions (Nikola et al. 2014). Semantic destination management systems offer complete integration, flexibility, and personalization. They have the ability to combine marketing and management into multiple products and services; they offer the flexibility to integrate single tourist destinations; and the targeted information that they supply, the services can be personalized to meet the customers' needs (Nikola et al. 2014).

The amount of data that biomedical research involves presents a challenge in terms of its analysis. The data is abundant in quantity, in types of format and in sources, which hinders data integration and interoperability. Translational medicine works towards minimizing the cleavage between research and medical practice. The accomplishment of its mission statement relies greatly on data integration and interoperability, thus, translational medicine has been focusing on Web 3.0 for its capacity of semantic depiction and data interoperability. The systems that are already in use that implement Web 3.0 technologies have proven efficient in terms of public and private data integration, semantic representation, and knowledge extraction. The challenge for the future is to help these semantic web systems to evolve from a local-scale approach to a network of collaboration and partnership (Machado et al. 2015).

The e-Government sector is responsible for numerous services that involve both their national borders and their international relations, and a variety of agencies. This mission implies the management of colossal amounts of data deriving from a multiplicity of sources, which is hindered by insufficient automation and interoperability. In order to address these challenges, semantic web technologies can be considered. Liu et al. (2013) suggest applying semantic business process management to e-Government by designing a framework that consists in four layers: data, process, semantic and presentation. This framework uses semantic technologies allied with business process management to improve automation, interoperability and data integration and reuse. Additionally, it is important to invest in methodologies for ontology development. In order to take advantage of Semantic Web technologies, it is imperative to develop a government domain ontology (Dombeu and Huisman 2011).

Weather forecasting information is central to a panoply of sectors and as the number of different systems, formats and parameters become involved in producing information, more strategies need to be put in place to assure its quality. The use of semantic technologies in this field is essential to facilitate the integration of data form multiple sources and the interoperability between different applications and systems. The employment of the semantic web maximizes the potential of knowledge integration in an area where the accuracy of the information is determinant (Ramar and Mirnalinee 2014).

8.3 Conclusion and the Future

The above depicts the need for novel interfaces capable of coping with issues of (i) variety, (ii) dimensionality and (iii) scalability. Moreover, these novel interfaces must be able to deal with multi-media information, 3D and augmented realities, and be able to adjust to various sectors and *niche* markets. There is a world of developments to evolve in the near future and the reader is invited to seat at the front row of these developments.

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