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SOCIAL NETWORK SITES - A TOOL FOR SPACE AGENCIES?

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Abstract

Following their successes in various domains, mainly with the general public, social network sites have been deployed within enterprises and are gradually replacing functions previously served by intranets and email communication. They are known to encourage informal communication between users and contribute to the social capital of the organisation. Such networks furthermore are reported to increase the internal information flow, facilitate or even revolutionise knowledge management, boost innovation levels and create senses of communities especially in organisations spread over different sites and cultures.

This paper assesses the potential for such networks for space agencies and reports on the introduction of an internal social network across all ESA sites. It discusses the objectives, scope and technical choices and analyses both quantitatively as well as qualitatively adoption rates, difficulties, and first impacts on the internal organisation.

Keywords: organisational management, social networks, social network sites,

1. INTRODUCTION

Social network sites have become an almost indispensable tool for an increasing number of persons, pioneered by the young generation and since some years with high growth rates among all age levels. [1–5] Since a few years, they have been deployed within enterprises and are gradually replacing functions previously served by intranets. They are known to encourage informal communication between users and contribute to the social capital of the organisation. Such networks furthermore are reported to increase the internal information flow, facilitate or even revolutionise knowledge management, boost innovation levels and create senses of communities especially in organisations spread over different sites and cultures. [6–21]

Lin and Lu reported that in 2011 social network sites were the worlds fastest developing personal networking tool. [22] With an increasing amount of the overall communication flow migrating gradually from email to social networks, companies and governmental organisations such as space agencies are facing similar problems and opportunities as with the introduction of emails more than a decade ago.

1.1. Scope

In recent years, an increasing number of scholarly papers have started addressing roles, options, opportunities and risks created by the use of social network sites for businesses. [9, 13–17, 20, 21, 23–26] A small fraction of these has also addressed such aspects specific for governmental entities. [11, 12, 27–29] Almost no research is available regarding the use of social networking sites within the space sector in general and space agencies in particular. [30, 31]

Following Turban et al., enterprise social networking can be classified into the use of public and private social networks by firms. [16] Both are increasingly popular. The most popular public social network sites also used by businesses and organisations in 2011 and 2012 include sites such as *LinkedIn*, *Facebook*, *Twitter*, and *ResearchGate*. These social and business-oriented networks are public, in the sense that they allow anybody to join and organisations and individuals alike to build networks and communities. Most of these commercial service providers are driven by advertisement revenues linked to the presence of users on their sites and the information these are providing on and via such sites.

Similar services are offered by private social networks, with the notable difference that access is restricted to a selected group of persons, usually company employees, customers, developers. In the scholarly literature, these are referred to as corporate networks, enterprise networks or simply internal social network sites. [16]

While there is an increasing amount of research papers on the potential offered by the use of public social network sites to organisations, published papers on the effects of the introduction and continued use of internal, private social networks are still scarce. Similarly, the space sector, and especially space agencies have been augmenting gradually since some time their use of public social network sites to engage directly with the general public. All major space agencies of western democracies use to a varying degree public social network sites. On the other hand, there are little more than sparse and anecdotal reports on the use of internal social networking sites within space agencies. [12, 27, 28, 30–32]

Historically, the introduction of email two decades ago, with its speed of communication and its independence from geo-

graphical locations has substantially increased organisational efficiencies, changed working cultures and hierarchies within organisations as well as the organisation of customer relationships. It has on the other hand also created new challenges, such as those related to increasing time spent on reading and answering emails and to data security. Similar opportunities are offered and comparable questions raised by the introduction of the use of social network sites.

The general impacts of social network sites is started to be studied by social sciences researchers since some years. It is much larger than could be covered in the present paper. In a recent paper in the journal *Nature* Giles argues that is has even created the entirely new discipline of computational social science studies. [33]

In a recent paper attempting to explain social media and its potential to businesses, Kietzmann et al. [8] argue that "we are in the midst of an altogether new communication landscape", given the numbers of persons using highly interactive platforms in their daily lives, the exposure social network sites get in the popular press and the potential for sharing, co-creating, discussing and modifying user-generated content on web and mobile based platforms. [8]

The scope of the present paper is to explore the potential of social network sites for space agencies, focussing on internal, private social network sites and report on first results in implementing such a site within the European Space Agency (ESA).

1.2. Social network sites

1.2.1. Terms and definitions

For the purpose of this paper, we will use the definition of social network sites proposed by Boyd and Ellison [34]. Social network sites are "web-based services that allow individuals to

1. construct a public or semi-public profile within a bounded system,
2. articulate a list of other users with whom they share a connection, and
3. view and traverse their list of connections and those made by others within the system. The nature and nomenclature of these connections may vary from site to site.

[...] While SNSs have implemented a wide variety of technical features, their backbone consists of visible profiles that display an articulated list of 'Friends' who are also users of the system. Profiles are unique pages where one can 'type oneself into being' ". [34]

In a more recent study, Lin and Lu define a social network site as "a cyber environment that allows the individual to construct his/her profile, sharing text, images, and photos, and to link other members of the site by applications and groups provided on the Internet. Hence, social network sites enable users to present themselves, connect to a social network, and develop and maintain relationships with others". [22]

An alternative, slightly broader definition is used on wikipedia: "A social networking service is an online service, platform, or site that focuses on facilitating the building of social networks or social relations among people who, for example, share interests, activities, backgrounds, or real-life connections. A social network service consists of a representation of each user (often a profile), his/her social links, and a variety of additional services. Most social network services are web-based and provide means for users to interact over the Internet, such as e-mail and instant messaging. Online community services are sometimes considered as a social network service, though in a broader sense, social network service usually means an individual-centred service whereas online community services are group-centred. Social networking sites allow users to share ideas, activities, events, and interests within their individual networks."[35]

Bennett et al. attempts a slightly different definition by proposing that "typically, a social networking service focuses on building online communities of people who share interests and/or activities, or who are interested in exploring the interests and activities of others."[14]

This paper follows also the reasoning of Boyd and Ellison [34] concerning the preferred use of "social network site" instead of the synonymously used "social networking site".

We also refer to Boyd and Ellison for a short history of social network sites, which date back to the late 1990s. [34]

Social network sites are a phenomenon within the larger class of 'social media' sites. These are in rapid development and vary strongly in terms of their scope and functionality. The most common sites are those targeting the general public (such as Facebook, Twitter, QZone, Google+, Sina Weibo, ...)[3–5]. Other sites (such as like LinkedIn and Xing), are more focused professional networks, while others target specialised communities such as researchers, academics etc (ResearchGate, Academia.edu, etc). Social media sites also include more general media sharing sites such video and photo sharing sites as well as blogging, including micro-blogging sites.

1.2.2. Fast increase of the use of social network sites

The success of initially exponentially increasing users levels of some commercial social network sites (e.g. initial growth of *Facebook* with close to one billion users in 2012) and *LinkedIn*) has spurred a growing number of competitors offering similar services.

At the same time, this rapid growth has not yet allowed the development of standards and standardised interfaces. Very few of the underlying systems are based on open source code and in most cases, data transfer from one site to another is not possible.

It can be argued that the materialisation of real social networks through the use of social network sites also allows to account for the actual value of networks and contacts. The value of social networks for both career advances as well as productivity and thus the overall efficiency of organisations has long been recognised. Bennett et al. argue that "being able to network and maintain contacts through life and work is one of the most crucial aspects for success, but is often one of the most overlooked areas. It is hidden, intangible work that is unaccounted for in any employee performance appraisal."[14]

Fraser and Dutta argue in a widely read book that social networking tools have substantially contributed to the success of the presidential campaign of Obama in 2008. [15] They identify five reasons why and how social networking tools and their sites had an important influence on election politics. These include the option to bypass traditional media, the low amount of resources required, its suitability for grassroots funding schemes and the option of civic engagement, conveying a sense of involvement and empowerment. The authors report that the US presidential candidate was reaching almost instantly at time of his choosing 2 million persons by just updating his online page on the commercial social network site Facebook, which had cost him less than $ US 0.5 Million. They conclude that the power of such means "will, inevitably, produce an eruptive impact on our political institutions". [15]

Similarly, it was reported that the use of social network have substantially contributed to the emergence and organisation of the political changes in what has been termed the "Arab Spring". [36–38]

Online social networking is increasingly being seen as part of normal human interaction. Looking at potential addictive properties of the use of social network sites, Kuss and Griffiths have published a comprehensive literature survey on the topic "intended to provide empirical and conceptual insight into the emerging phenomenon of addiction to social network sites" by outlining usage patterns, examining motivations for usage, examining personalities of users, examining negative consequences of usage, exploring potential addiction, and exploring addiction specificity and comorbidity. Their findings indicate that "negative correlates of social network sites usage include the decrease in real life social community participation and academic achievement, as well as relationship problems, each of which may be indicative of potential addiction."[39]

However, as Barkol et al. report in a 2012 paper, the importance and the lasting impact of social media in general and social media sites is not universally shared and many companies still remain sceptic. Barkol et al. equate this to the initial dismissal of the internet by some: "Much like many old-line companies initially dismissed the Internet, electronic commerce, integrated digital marketing and digital strategies in general as short-lived 'fads', social media is still considered by many to also just be a transitional fad."[1]

The success of well known sites with the general public has also increased the interest of businesses and even created entirely new businesses. Bennett et al. go even one step further to argue that "social networking is among one of the most significant business developments of the twenty-first century by adding another dimension to the way people communicate all over the world."[14] The next section therefore reviews briefly the scholarly literature on reported uses of social network sites by and within organisations.

1.3. Uses of social network sites by and within organisations

In an early work on the use of computer aided cooperative work and the rise of personal social networks in the workplace from 2002, Nardi et al. report the then surprising finding that the most important unit in what they call 'intensional networks' is not the team but the individual: "Paradoxically, we find that the most fundamental unit of analysis for computer-supported cooperative work is not at the group level for many tasks and settings, but at the individual level as personal social networks come to be more and more important. Collective subjects are increasingly put together through the assemblage of people found through personal networks rather than being constituted as teams created through organisational planning and structuring. Teams are still important but they are not the centrepiece of labor management they once were, nor are they the chief resource for individual workers."[40]

Nardi et al. also argue that contacts in a network often require 'care and feeding', even though dormant contacts may be activated after surprisingly long periods of time. They further argue that employees social networks play an increasingly important role in the workplace and businesses need to recognise it as an opportunity to further enhance work-based communication practices. [40]

Social network sites have arguably begun to change the way we live and will also impact the way we work. [16] With employees getting used to the efficiency and convenience of communication means provided by social network sites for their lives outside of work, it is inevitable that these same persons would want to use such tools also for their work-related communication. Andriole published in december 2010 statistical data on the use of Web2.0 tools in US companies. 25% of these reported to use internal social networks (compared to over 60% using internal wikis and still more than 40% allowing their employees to have personal blogs.)[26]

van Zyl cite a study commissioned in 2007 that already then 83% of US office workers used office resources to access social media, 30% of US office workers and 42% of UK office workers admitted to discussing work-related issues via social media applications. (*ClearSwift* study cited in [13]). It can be expected with confidence that current values are at a similar level of higher. [13]

Turban et al. report in 2011 that "many enterprises are assessing the potential of exploiting the commercial opportunities of this technology. Although social networking commercial activities may be the next big productivity booster for firms, some consider such activities to be time wasters and security traps."[16] They therefore proposed a framework to consolidate the issues in adopting this new technology and review the opportunities provided by enterprise social network sites. Following an identification of major risks, Turban et al. then propose some mechanisms for their management. [16]

Kietzmann et al. [8] argue that despite the incredible success, high popularity and disruptive potential of social network sites, "many executives eschew or ignore this form of media because they dont understand what it is, the various forms it can take, and how to engage with it and learn."[8] In an attempt to remedy this situation, the authors have proposed a framework that defines social media by using seven functional building blocks: identity, conversations, sharing, presence, relationships, reputation, and groups. The emphasis of the different services is usually on some of these aspects, Kietzmann et al. then analyse

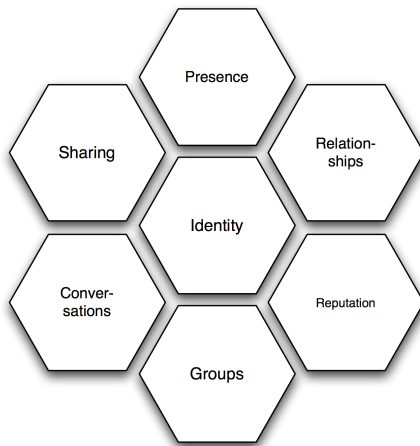how firms can take benefit from each of these elements. [8]

Figure 1: Schematic, symbolic representation of the honeycomb framework for social media analysis proposed by Kietzmann et al. [8].

1.3.1. Perceived effects of the use of social network sites on organisations

van Zyl has summarised, based on a literature survey, perceived positive and negative effects of social networking for enterprises as following:

+ Up to date contact information linked to user maintained profiles; *vs*

- Potential source of information which can be used in social engineering attacks

+ identification of experts, opportunities and potential business partners; *vs*

- Spammers and virus-writers can set up false profiles

+ Increased staff motivation and sense of community through the accumulation of a digital reputation; *vs*

- Decreased productivity caused by employees spending too much time networking and posting entries on blogs and Wikis

+ Retention of cumulative organisational knowledge and experience in a fully searchable format; *vs*

- User generated content can be unreliable and the potential loss of confidential or sensitive information

+ More effective, appropriate and efficient use of computer-mediated communication technologies; *vs*

- Resource waste with regard to bandwidth, server and network utilisation

+ The ability to influence the perception of the organisation and/or brands through improved customer relations, viral marketing and innovation; *vs*

- Damage to organisational reputation either through intentional acts of vandalism and misinformation or through negligent acts or omissions

1.3.2. Impact on corporate communication by social network sites

The rise in social media in general, including social network sites, also have profound implications for corporate communications. It has been described that the diversification and democratisation of the communication channels took some power away from those in marketing and public relations. Communication about products, companies, organisations and brands happens, with or without permission of the organisations in question. The reaction to this evolution varies, from ignoring it to fully engaging with this trend.

Kietzmann et al. conclude in their study that corporate communication appears to have been democratised by the rise of social media, and that "the power has been taken from those in marketing and public relations by the individuals and communities that create, share, and consume blogs, tweets, Facebook entries, movies, pictures, and so forth". [8] Since such communication about brands happens, with or without permission of the organisations and brand owners in question, the question raised by Kietzmann et al. for organisations is only whether they decide to "get serious about social media and participate in this communication, or continue to ignore it. Both have a tremendous impact."[8]

1.3.3. Internal social network sites and innovation processes

In the frame of their study in 2010, Andriole found interestingly that internal only "Web 2.0 technologies have little impact on the innovation process. There are spotty innovation applications of crowdsourcing for R&D and selected applications of folksonomies[1], RSS filters, and mashups, but the area is generally not affected." while "Web 2.0 tools, techniques, and especially attitudes will alter the innovation process in many industries by facilitating direct communication and collaboration among creators and buyers of new products and services, thus shortening the innovation life cycle."[26]

Contrary to this account based on actual interviews and observations, the scholarly literature on open innovation considers the use of social media in general and social network sites in particular as key enabling tools to allow organisations to engage and fully benefit from open innovation. [42–44]

Bennett et al. associate the use of social networks as an important tool especially during economically difficult periods in order to increase workplace productivity and employee satisfaction at the same time with relatively little resources. They quote from a previous paper [45] the claim that "Combating the twin aims of increasing workplace productivity and employee satisfaction is a challenge at the best of times but in the middle of a downturn it is even more so, but certainly not impossible. Revitalising and possibly even reinventing the culture of companies and the way companies do business is key to achieving increased levels of workplace productivity and employee sat-

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[1]Wikipedia defines a folksonomy is a system of classification derived from the practice and method of collaboratively creating and managing tags to annotate and categorize content; also known as collaborative tagging, social classification, social indexing, and social tagging. [41]

isfaction" and conclude that "one method of achieving this is through social networking."[14]

Bennett et al. further claim that "organisations that have implemented social networking have experienced a shift in culture from 'information gathering' to 'information participation'. One could contend therefore that social networking can enable virtual workers to work more effectively through enhanced communication and collaboration as well as providing a plethora of detailed professional and personal information about contacts which can be immediately updated whenever people move jobs, offices, or departments. All of these practices are easy to implement and cost effective."[14]

1.3.4. Organisational acculturation and integration of recruits

Thom-Santelli et al. studied the impact and potential of internal social network sites in the process of what is termed "organisational acculturation". [17] The scholarly literature defines organisational acculturation as the process in which employees make sense of an organisations culture, its shared values. [46]

Nahavandi and Malekzadeh define, based on earlier work, four modes of acculturation in organisations: integration, assimilation, separation and 'de-culturation'. [46] Acculturation can be supported by formal training, or informally through social interaction with co-workers and observation. The scholarly literature clearly separates this process of the the process of socialisation. While socialisation deals with the strategies newcomers employ to become accepted members of a group, acculturation focuses on the learning and integration of these values into ones identity as an employee. [46, 47]

Based on a survey of 802 users from an enterprise social networking site, Thom-Santelli et al. have identified two groups of employees that perceive higher benefit from using a social network site to learn about the organisation's values and beliefs: 1. those new to the company and 2. those geographically distant from headquarters. They deduce that internal social network sites can "potentially contribute to the information-seeking and sense-making activities that underlie organisation acculturation."[17]

They further hypothesise that the informal nature and frequent updates can provide users with a low risk way to learn more about an organisation. Underlining this hypothesis, Steinfield et al. report that new employees who were active users of an internal social network site reported greater access to new people and expertise and that users at sites remote from the main organisational establishment gain higher value from the use of internal social network sites. [20]

1.3.5. Social Capital

The use and benefits of social network sites are sometimes dealt with under the heading of 'social capital' of organisations. The term 'social capital' broadly refers to the resources that derive from the relationships among people in varying social contexts. [48] The term is defined at several levels, from the individual one to the group level, the organisational level and even national levels.

It therefore represents the knowledge flows among individuals in an organisation. Coleman and Baron and Markman

defined is as "the actual and potential resources individuals obtain from knowing others, being part of a social network with them, or merely being known to them and having a good reputation"[49, p. 107][48]. Ardichvili et al. suggest that online communities strengthen the social capital by strengthening the ties between people who have met in earlier face-to-face meetings, but would not have kept in touch if not for the network. [50]

In a more recent study specifically addressing the relationship between social capital and internal social network sites, Steinfield et al. explore the relationship between various dimensions of organisational social capital and the use of an internal social network site. They find that that "bonding relationships, sense of corporate citizenship, interest in connecting globally, and access to new people and expertise are all associated with greater intensity of use of the social network site". [20] Steinfield et al. therefore conclude that such network sites enable individuals to locate useful information, draw on resources and make contributions to the network.

1.4. Conditions for a successful social network site

1.4.1. Trust

Trust has been identified early on as a key condition for the success and the continued use of social network sites. Changes to privacy policies of social network sites tend to create substantial public discussions and online feedback.

Grabner-Kräuter has published an in-depth analysis on the origins and reasons why users tend to trust online social network sites more than what might be expected. [51] She focusses her paper on theory-building on trust as a critical issue in such networks and develops a proposed theoretical framework to facilitates a multi-level and multi-dimensional analysis of research problems related to trust in social network sites. Based on an analysis of the structural and relational underpinnings of trust in such networks she investigates these aspects from a governance perspective that integrates concepts of social network theory, social capital and the role of value in relational exchanges. Grabner-Kräuter then analyses the individuals decision to trust and the processes through which trust emerges.

In an earlier paper, potentially directly applicable to internal social network sites, Ardichvili et al. speculated that one of the reasons for a person's "participation in a community populated mostly by strangers" would be the employee's trust, not in individual members, but in a larger social entity, the whole organisation. [50] Ardichvili et al. deduces that members would need to have trust in the integrity of the organisation as a whole, and the competence of its members. Such an institution-based trust tends to be based on the belief that necessary structures are in place. which will "ensure trustworthy behaviour of individual members, and protect the members from negative consequences of administrative and procedural mistakes"[52] They conclude that in order to succeed organisations need to "make the organisational expectations and procedures transparent through clear and widely accessible communication of these expectations and rules."[50]

1.4.2. Complementarity, not replacement of face-to-face interactions

It is important to understand the limitation inherent in the use of social network sites for the maintenance of a functioning social network within an organisation, and especially the importance of face to face communications. Ardichvili et al. therefore conclude in their paper that organisations need to aim to offer online communities for complementary purposes instead of trying to supplant face-to-face communities with online ones. They further conclude that organisations should "capitalise on the existing communities and assist them in using the online communities to increase the effectiveness of their work, by providing a unique space for knowledge generation and exchange, which goes beyond of what is available in regular, face-to-face collaboration situations."[50] A similar pattern has been reported from a study of the usage of an internal social network site at a large international IT organisation by DiMicco et al. and Thom-Santelli et al.. [20, 21, 23, 53].

1.4.3. Designed for users - not for knowledge managers

In order for social network sites to succeed, the user and its needs, requirements and habits need to be at the centre of the design of such sites. In an analysis of the challenge in enabling virtual communities of practice, it was found that creating them was the easier part since most communities emerge spontaneously, but that removing barriers for individuals' participation, supporting and enriching the development of each individual's uniqueness within the context of the community, and linking that uniqueness with the community purpose was the more difficult aspect. [50]

This findings has direct implications on the role of units within organisations formally in charge of knowledge management since it suggest that their role needs to be much more passive than what might be assumed. Ardichvili et al. recommend that for the virtual communities of practice model of knowledge management, the role of knowledge management professionals is not so much to aid in capturing and distributing knowledge, but to create conditions for its generation and dissemination. They furthermore then suggest that such work is best achieved by "enabling community interactions, by promoting conditions for an open exchange of ideas and information, by creating time and space for exchanging stories and expertise, and by supporting innovative thinking" and warn that "knowledge management professionals must avoid an attempt to manage communities of practices". This finding resonates with a common theme found in the scholarly literature on the negative perception of being managed by communities of practices in organisations and that outside management efforts risks throttling otherwise thriving communities of practices. [54, 55]

Ardichvili et al. recommend strongly to knowledge management professionals that their role needs to be the "understanding [of] the dynamics of interactions occurring in these virtual spaces, and helping the participants to unleash their creativity" and to "study the spontaneously emerging forms of informal learning, and knowledge generation in virtual communities of practice, identifying what needs to be done to facilitate this learning, without imposing artificial restrictions, without inhibiting the spontaneity of these informal interactions."[50]

1.5. Limits of social network sites

Social network sites allow users to communicate practically independent of geographic location and help sustaining relations with a range of persons. There is considerable amount of research on the effect of social network sites on human relations, showing that the specifics of interacting with others via online social network sites also changes the very nature of our relations. (see the pioneering work by S. Turkle e.g. [56–58]

Nardi et al. [59] for example report on the importance of face to face communication, the type of communication happening at coffee breaks and in real meetings for workplace communication. They find and characterise in their paper via an ethnographic research on workplace communication, uniquely valuable aspects of face-to-face communication, especially in sustaining social relationships. On the other hand, they also identify its limits and describe situations when other media are preferable. From this analysis they discuss ways to design 'media ecologies' that provide cost-effective solutions to the problems of distributed organisations. [59]

2. REQUIREMENTS AND CHARACTERISTICS OF AN INTERNAL SOCIAL NETWORK SITE SPECIFIC TO GOVERNMENTAL SPACE AGENCIES

2.1. General differences between general public and internal social network sites

The relatively few scholarly articles and published data on the use of social network sites within organisations are mainly dealing with private, typically technology-oriented corporations. Only very few studies are published on the use of social network sites in public organisations and governmental institutions. [9] Apart from descriptive reports and articles in the media, to the best of the author's knowledge, there are no scholarly articles on the use of internal social networks within public space agencies. NASA has introduced a version of an internal social network site (*spacebook*), though the service has been discontinued. [12, 28, 30–32] Many of the social network site related requirements of public organisations and governmental institutions also apply for space agencies. Some are however distinct. This chapter therefore attempts to first report on the common characteristics as published in the available literature and then derive some specifics for public space agencies.

In one of the few papers focussing on the use of social network sites in a governmental agency, Rooksby and Sommerville report on the challenges and opportunities of introducing and working with social network sites in the UK Home Office, a large governmental department employing 24000 people over multiple locations. [11] One of the surprising findings of this research is the difficulties in integrating not only one but two parallel internal social network sites and the use of up to five public social network sites into the workflow of its employees.

Grasso and Convertino [9] propose in a recent article in preparation of a conference series dedicated to defining a research agenda on collective intelligence in organisations a list of three properties particular to enterprises (compared to the general public) regarding the adoption of general Web2.0 tools and social network sites in particular [9]:

People and roles. "The people using technology are workers, who are assigned roles and perform specific and more or less stable jobs. Generally, they know each other (even indirectly), are paid to work, and are part of a reporting structure. The contributions of the individuals are monitored and evaluated, while the job roles and reporting structure are the means for the organisation to distribute responsibilities, keep accountability, and monitor the performance. Moreover, in the organisation, there is a growing emphasis on utilising teams, task forces, and communities of practice as a strategy to improve performance [. . .]. Such work units are not formed on the basis of personal interest, but are assembled by the management, given the functions needed and the experts available. Typically, the workers have to coordinate with (and rely on) others for the organisation to be productive as a whole."

Tools and tasks. "Both the tasks performed and the tools used (email, phone, content editing tools, databases) are non-discretionary. Typically, they are assigned by the management and not chosen by the workers. Also distinctive is that the tasks are increasingly information and interaction intensive and workers in enterprises increasingly need to make sense of large amounts of information from multiple channels or information tools. This existing ecology of systems creates barriers in fitting in new tools, for which often there is a conflict between who gets the benefits and who bears the costs of using the tools."

Goodness criteria. "The criteria used to evaluate and predict the success of technology are also different. In the consumer space, these are mainly the utility to the user, quality of user experience (e.g. simplicity and fun), and social benefits. In organisations, the key criteria over and above those for the consumer space are the workers productivity (e.g. workers output and workload), the organisations productivity (i.e. ROI) and compliance to internal and external SLAs, political returns, security, and compatibility with the legacy infrastructure. Therefore additional constraints for Web 2.0 tools in organisations include compatibility with prior tools, security, costs of maintaining new tools, and the fit with the current management structure, work practices, and motivational mechanisms."

It is reasonably to assume that all three of these core differences are similarly applicable also to the case of the use of internal social network sites at space agencies.

2.2. Generational changes with respect to the use of internal and external social network sites and expectations of new recruits

On the other hand, new recruits of the sometimes termed 'Generation Y' enter organisations with an expectation of use of communicating via social network sites as part of their normal communication channels, with frequently a blurred limit between the use of private and company related information in their communication. Enterprises have reacted to this development in typically three different ways: establishing policies preventing the use of all or certain social network sites, establishing policies and/or guidelines and restricting the use of such site (both measures usually justified on security and data protection grounds) or in exceptional cases either tolerating silently or even encouraging their employees to use public social network sites. The last category is dominated by young, strongly customer oriented and technology companies. However, as reported by (add there the paper that reports fear dominates)

2.3. Motivations of employees for the use of internal social network sites

A substantial body of scholarly work has emerged since the early 2000s on the the motivations of users to use online social network sites. [22, 50, 60] Lin and Lu have combined network externalities and motivation theory, to propose a rational research model to explain why people use and join public social network sites. Their study is based on online interviews and questionnaires on Korean users of the commercial social network site *facebook*, and thus their conclusions might be culturally biased. The general theoretical framework seems in principle also be applicable to private social network sites.

Lin and Lu base their analysis on the motivations underlying individuals behaviour on the work by Deci [61] into *extrinsic* motivation and *intrinsic* motivations. In this framework, *extrinsic* motivation refers to committing an action because of its perceived helpfulness in achieving value (e.g. the performance of improvement), while *intrinsic* motivation refers to committing an action because of interest in the action itself, rather than external reinforcement (cited by Lin and Lu from [62]). Lin and Lu proposed extrinsic benefit (*usefulness*) and intrinsic benefit (*enjoyment*) as the components of individuals perceived benefit in social network sites. (see Fig. 2 for a schematic representation)

For network externalities, they base the analysis on the theoretical work of Katz and Shapiro who evaluated that "the utility that a given user derives from the good depends upon the number of other users who are in the same network as is he or she" and thus the value or effect that users obtain from a product or service will bring about more values to consumers with the increase of users, complementary product, or service. [63] For general services and product, but especially social network sites, the scale of users is a critical parameter for the success to attract more users and thus increase the value of the service for individual users.

Network externalities tend to be classified into two types: *direct* and *indirect*.

While *direct* network externalities derive from the increase in users of a particular product or service, where users benefits increase, *indirect* network externalities display an increased sense of user value from using a product or service, as the effect the user obtains from such product or service increases with the increase of related, complementary products. [22]

Fig. 2 schematically represents the construct as developed by Lin and Lu [22] for the analysis of the continued user of social network sites.

Figure 2: Schematic representation of the paths from network externalities, via usefulness and enjoyment to the continued use of social media sites. Dashed lines represent insignificant contributions based on the data analysed by Lin and Lu. (adapted from [22])

Sledgianowski and Kulviwat introduce a social network site adoption model to examine the effect of perceptions of several distinct parameters on usage intention and actual usage of these sites: normative pressure, playfulness, critical mass, trust, usefulness, and ease of use. [6] They use structural equation modelling to examine the patterns of inter-correlations among them. They derive that among all the determinants with a significant direct effect on the intent to use social network sites, perceived playfulness and perceived critical mass have been found as the strongest indicators. Lin and Lu relate these findings to peer network externality as one of the sources of network externalities.

In principle, both network externalities as well as motivation theory should be similarly applicable to the analysis of the motivation of users of internal social network sites. While there are no solid data, it seems however reasonable to assume that usefulness and ease of use would be ranking higher for such internal sites.

In a 2008, relatively early paper on the motivations for social networking at work, DiMicco et al. [23] report on their findings related to the specific differences of the use of social network sites for private and for work purposes on the basis of usage of an IBM internal social network site, one of the earliest and best documented internal social network sites. [23] They conclude that the patterns of use and user motivations differ from users of public social network sites. Within private internal social networks, employees are more eager to reach out to new people, rather than connecting only to those they already know. It was found that users do not use the site to share and engage with colleagues they know well already and work with closely, but they rather use it to connect with employees they would like to know better.

Based on a more qualitative than quantitative analysis, including the evaluation of a limited number of highly engaged users, DiMicco et al. [23] classify the motivations of IBM employees for participating in the internal social network into either one of the three categories: *caring*, *climbing* or *campaigning*.

Caring Interestingly, the first aspect, *caring* came out to be the strongest and most consistent motivation. DiMicco et al. report that "there was a constant theme that connecting on a social level was a source of personal satisfaction" and that "the number one reason employees gave for wanting to use the site was that they enjoyed connecting socially at work", which clearly points towards a human personal need for social interactions, and which internal social network sites seem to satisfy at least to a certain extent or better than other tools.

Climbing A subset of users analysed by DiMicco et al. reported their motivation of the use of the internal social network as a tool to advance their personal careers. Similarly there were however others who expressed some concern of the contrary, that their use of such a tool could be harmful for their career. Typical user behaviour patterns linked to this motivation were actions to get known by senior management (such as posting on their profiles) and commenting on professional subjects to show expertise and interest to internal groups in order to prepare career moves.

Campaigning DiMicco et al. classify all those motivations that were linked to putting ones ideas forwards, supporting a project or cause, motivating or attracting support and interest to certain activities and projects as *campagning*. These range in the reported study from gathering support for own projects to brainstorming about suggestions to address company internal shortcomings, problems or other issues. Such users have been found using the internal social network for this goal since "the existing corporate communication channels, typically through ones hierarchy, are limiting for these users; the new found freedom to connect and communicate with anyone on the site is providing a new means to achieve users project goals."[23]

2.4. Engagement of governmental organisations in social network sites

In a report by the EU Joint Research Centre on the potential use of all sort of Web2.0 technologies for governments, including social networks, Osimo concludes that "web 2.0 presents significant opportunities as well as risks for government, in several areas. Civil Society Organisations, individual citizens and civil servants are already using these applications in relation

with government activities, outside the reach and control of institutions." and therefore recommends that "engaging with web 2.0, and learning how to cope with this loss of control, appears not only to open avenues for a more effective administration, but also constitutes a necessary element of a risk management strategy."[64]

In the US, the Obama administration has take an even more bolder step in actively encouraging governmental organisations to use these tools to collaborate and open up to external scrutiny and interaction with the general public. Rooksby and Sommerville quote a US presidential memo to this effect. "Government should be collaborative. ... Executive departments and agencies should use innovative tools, methods, and systems to cooperate among themselves, across all levels of Government, and with nonprofit organizations, businesses, and individuals in the private sector. Executive departments and agencies should solicit public feedback to assess and improve their level of collaboration and to identify new opportunities for cooperation." (quoted in [11])

The open government initiative answers to this general strategy. Interestingly NASA has been one of the most active federal agencies in embracing this initiative. In their own words, "Whether NASA is using social networks to allow students to interact directly with astronauts, or creating a Cloud Computing Platform to give unprecedented access to scientific data, we have embraced Open Government. But there is still more to do: NASA is expanding transparency, participation, and collaboration and creating a new level of openness and accountability. We are focusing on embedding open government into three integrated aspects of our operationspolicy, technology, and culture."[65]

2.5. Specific aspects of the space sector

Most of the specificities of the usage patterns, user motivations and opportunities and risks related to the use of internal social network sites in governmental agencies can be assumed to apply directly also to such sites within the space sector. However, the space sector and space agencies have developed some quite unique attributes, which also might have consequences on the use of internal social network sites.

From purely governmental activities during the first decades, space has gradually matured and a few areas have developed a substantial commercial basis, such as the telecom sector. Most space applications are however still largely dominated by governmental activities and government priorities. In the words of a foresight report on space by the Organisation for Economic Co-operation and Development (OECD): "[...] space business is not business as usual", for essentially three reasons: 1. Governments set the rules and the conditions for space activities (including private ones) and tend to intervene heavily in their activities; furthermore, most research and development in space is financed or done by governmental entities; and finally, governments are the most important customers of space products and services. [66]

Space agencies, still the main actors in many space activities, show organisational structures that are inspired by public administration organisations, larger research centres and strategy-driven, governmental high-technology project organisations established during the second half of the 20th century, which had themselves a considerable impact on the shape on space industries.

Space agencies are thus typically hierarchical organisations, where highly skilled knowledge workers are grouped together in specialist lines of services. Since the 1970s, scholarly work, pioneered by Granovetter, has established the importance of *weak ties* especially in hierarchical organisations, in order to be able to gain access to specialist knowledge and information present in other social networks (lines of services). [67, 68] In such organisations, organisational resources are often wasted when employees have to reinvent fixes or solutions to problems, which have already been created by someone else within the organisation.

Since space is an unforgiving environment and activities in general are high-risk endeavours of high value, the internal organisation of the work needs to take into account the very stringent requirement to reduce at all levels the risks of errors and failures. The importance of the reliability and traceability of information at all levels is therefore important in internal processes. As in most organisations knowledge is usually managed by grouping knowledge workers into processes and services, in which processes and requirements are communicated downwards by management, providing clear lines of responsibility and communication channels. As van Zyl points out, in such hierarchical structures new employees need only one connection, which is their manager, to obtain the relevant knowledge required to perform their work, either through one-on-one communication, training programs, training manuals, or procedure manuals. [13] Similarly, new knowledge is also produced within these closed, hierarchical groups, contrary to the mechanisms popularised by Tapscott and Williams under the term of "wikinomics". [69]

The user of internal social network sites seem to offer a mean to open up these closed information systems without reducing their value in keeping the information reliability necessary for space projects.

The third aspect under this section is the fact that the space sector is a relatively small niche sector, with a limited number of employees, who furthermore are subdivided into relatively closed specialisation areas. The present paper does not address the opportunities that public social networks offer in this respect to actors in the space sector, e.g. by allowing them to breach the traditional barriers between them and the interested general public. Within this relatively small sector, employees therefore tend to connect to others in the same specialisation area via traditional means (workshops, conference, projects).

3. INTRODUCTION OF A SOCIAL NETWORK AT ESA

This section reports on the first months of the gradual introduction of an internal, private social network site inside ESA. It contains information on its motivation and objectives, the organisational and technical decision criteria, the user adoption patterns and feature evolution of the site as well as feedback and lessons learned. The different subsections are structured in

order to allow other space agencies and comparable organisations considering the introduction of an internal social network to benefit from it.

3.1. Origins

In the process of drafting a strategic document for ESA, Agenda 2015, its Director General also solicited input from all ESA employees in form of a novel, online discussion forum enabled specifically for this task in early 2011. The forum was behind the firewall, accessible to all employees with access to the intranet and an ESA email address and based on the open source tool Drupal.

The success of this forum not only spurred within months two other targeted discussion fora but also the request by users for the availability of such a discussion platform on a permanent basis. This request was taken up by ESA's Director General Dordain in his Agenda 2015 document as a means to increase the internal efficiency as well as make ESA a more person centric organisation. [70]

3.2. Objectives

The decision to offer employees an internal social network site was taken with three main objectives:

1. Transfer people's knowledge into searchable, easily accessible information
2. Create a more integrated workforce
3. Foster the inception, exchange and growth of ideas

3.2.1. Knowledge management

ESA is engaged in a wide variety of activities, involving and requiring a workforce with highly specialised and at the same time very diverse competences. ESA is furthermore a project and result oriented organisation, creating integrated, highly motivated and success-driven teams to achieve generally very challenging space mission objectives, with tight schedules. Traditional, centrally managed knowledge management systems struggle especially in such environments, where the documentation level (required by stringent quality control and interface management of complex systems involving sometimes several hundreds of subcontractors) is already high. Social network sites are seen by an increasing number of scholars and practitioners alike as a way to overcoming some of the traditional barriers by bringing the human side into the knowledge management equation. This has been known in the late 1990s and early 2000s as "virtual communities of practice". [50, 60, 71, 72]

The importance of the information flow via what is usually termed the "office social system" in the provision of a collaborative learning environment, in which problems encountered are collectively solved and solutions are shared among peers, bridging the gap between procedures and practise has been studied and well recognised. [13] Organisations distributed over several sites put natural barriers to this important component of knowledge management. Time pressure, and the resulting decreasing time for informal exchanges further diminish this contributor to knowledge management.

Similarly, currently knowledge and information span across many types of communication tools, document formats, desktop applications, and sources within and outside the firewall. [13] Proponents of the use of internal social network sites have long argued that such sites have the potential to integrate different modes of computer mediated communications into one application, without necessarily modifying the original source, but by e.g. allowing users to add labels.

Such tools are especially useful for organisations like ESA and most larger space agencies, which require exchanging and sharing of knowledge across different sites. Most importantly, and contrary to the use of email, information shared via social network sites is recorded, linked to the person who created it and remains accessible and search-able. Knowledge management in this sense is done by and for the users themselves, while sharing, commenting, uploading, adding.

Such systems however only work if they provide the incentives to share information. While Grasso and Convertino has elaborated on a list of properties of collective intelligence and social network sites particular to enterprises, the motivation of staff for sharing information and knowledge in an intranet within an organisation is also different from sharing on public social networks. [9]

3.2.2. Workforce integration

The strong focus and mission success orientation of ESA projects has also led to certain island-building effects among its employees, which is further accentuated by a quite hierarchical internal organisational structure, with typically four management levels below the one of the Director General. While internal career moves of staff are in principle encouraged, in practice there are a number of obstacles to a fluidly changing and moving internal workforce.

Therefore, the internal social network site has also been designed to lower internal organisational barriers between different units, increasing the information flow between these and allow users to exchange and find information independent of their organisational affiliations within ESA. Given the high general workload, such a system requires to be intuitive and user friendly, integrate with the day-to-day tasks of staff and allows to save time instead of taking time.

The standard internal communication platform is the intranet, which has been gradually augmented to allow community spaces. Information however remains largely top-down and one way (it does not allow users to comment and discuss). The intranet therefore has been an important step in integrating ESA employees, though due to its inherent limitation in its current form it cannot create active user engagement.

3.3. Decision criteria and system requirements

When deciding on the main choices concerning the implement an internal social network site, the following criteria have been used. It needed to

- focus on the person, which includes

1. putting the person at the centre, not groups or hierarchical elements,

2. individualise the information displayed to the person, and

3. allow the individual to create, build and maintain it's own network.

- be simple and user-friendly enough to not require tutorials and manuals

- complement and not replace other services and tools

- integrate with existing internal authorisation, login and password services and use these (instead of requiring users to create new credentials)

- avoid system lock-in restrictions; the system should be as much as possible based on open standards, with many options for service providers. Evolutions and maintenance should not be tied to one company or service provider.

- run on internal servers behind a strict firewall and without any requirement for information exchange to servers outside the firewall

3.4. System and technical choices

Following a quick review and analysis of different implementation options and their respective compliance with the goals and requirements listed in the sections above led to the choice of basing the internal social network on the open source platform *Drupal Commons*. [73, 74] It essentially offers

1. a flexible platform with many existing modules covering all the basic elements of a social network site

2. an existing solid developer and user base and many different service providers

3. the option to be easily installed internally behind the firewall

4. the option to be adapted easily to integrate with other internal tools, especially existing user authentication systems

Commercial services hosting organisation's internal social networks have been discarded based on a short analysis including security risks, cost and user acceptance.

3.5. Content orientation of the site

Following the reported usage patterns of other internal social network sites and taking into account, both the published user motivation levels by DiMicco et al., as well as the goals of the site, the system was designed in a way to not provide any directions or preferences for certain types of contents over others. Users are equally encouraged to share work-related and non-work related content.

The name for the internal social network site, *esanet* has been chosen by it's users in a poll on *esanet* and reflects the very generic and open orientation of the site.

3.6. Analysis of *esanet* in terms of functional blocks of social media systems

Following the conceptual framework proposed by Kietzmann et al., *esanet* can be analysed according to its strengths on Kietzmann's seven functional building blocks.

Fig. 3 represents the outcome of this analysis graphically, by colouring those blocks in darker grey that are stronger present on *esanet*.

identity strong emphasis: The user is central on *esanet*. Substantial importance is put on the creation and the information provided in the personal profiles of users. *esanet* furthermore does not allow anonymous user contributions. All entries, inputs, posts and comments are linked to user profiles. Users can change their profiles without authorisations from line management, including their job description, their current and past project involvements, their competences and specific expertise. The personal profile is separated into 1. Professional background, 2. Projects and 3. Other information, which also includes options to share private information. Many fields are open fields, allowing users to enter as much information as wished. All information provided in the profiles is fully searchable and accessible to all users.

The *identity* focus of *esanet* is also highlighted by the fact that the personal profile contains the only mandatory fields to be filled in by users (job title, short description and specific competences). While users are not obliged to create their profile to use *esanet*, their account is not fully functional without the creation of a profile.

sharing strong emphasis: *esanet* shows a strong emphasis towards encouraging users to share information with others. Information can be shared on *esanet* in multiple ways, in an attempt to offer a mix that integrates well with most users. All posts are made public (visible to all) by default if not restricted to a specific group and all posts can be made to multiple groups at the same time, thus facilitating information exchange across communities. Information can also be shared via the use of a "bookmarklet", a dedicated shortcut in the browser bookmark tab area to share information on *esanet*, which does not require the user to be on *esanet*. Several post types are by default specified as being editable by all group members such as wikis, document folders and galleries.

groups emphasis: While initially not assumed to be important, the early user patterns and requests from users showed that groups are central to how users want to use *esanet*. In the frame of the early development phases, additional effort has therefore been made to enhance group capabilities on *esanet*. Groups have turned out to be the most used mechanism to share and communicate within *esanet* and users tend to prefer joining groups than following other users. All users, independent of their internal role or function can create groups and define the properties of these groups.

Groups can be fully open for anybody to join without approval, can require the approval of a group administrator or they can be administered as invite-only groups. *esanet* also offers the option to create groups which are not listed in the group directory and which are thus not visible to other users.

relationships emphasis: *esanet* offers users to follow other users. Following other users triggers content shared by these to be displayed on the main page and in the news stream of the follower. While such following is categorised under the term "relationship", it has to be seen as a light version of it, since it does not imply any endorsement, nor reciprocity. While information on followers is displayed on *esanet*, it is not emphasised and users don't receive information in case colleagues follow or no longer follow them.

conversations used: There is no emphasis on the conversational aspect. *esanet* allows users to exchange in forms of stream entries and comments to these, also in a private manner, not visible to others. Such conversations can take place in a one-to-one setting between two users, or within groups. Internal chat functions have not been implemented. The reason for this restriction was more of practical than principal nature. It was also decided to not enable the use of a *esanet*-internal messaging system, but to integrate it within the existing internal email service. This decision was taken to not create duplication and thus potential confusion, and to integrate the system with user workflows.

presence not used: *esanet* does not emphasise presence. While earlier trial versions displayed the number of users being on the site at any given time, this information is not longer shown, since the decision not to focus on the *conversation* aspect and not offering chats did not require online statuses displayed any more.

reputation not used: *esanet* has not implemented mechanisms to use reputation as an important factor. The number of posts, contributions of users is not in any way highlighted on the site, and users are not given the option to easily endorse other users as this is the case in many commercial social network sites. Such mechanisms, heavily employed by commercial social network sites have not been used until writing of this paper on *esanet* on the grounds that they risk to distort user intentions for sharing. This aspect, together with the *presence* described above are also revealing concerning some key differences between commercial social network sites and internal, private ones: Since most commercial social network sites are funded by advertisement as their main source of revenue, such sites have an incentive to motivate users to maximise the duration of users staying on their site. The motivation of internal social network sites such as *esanet* is almost the exact contrary since the organisation has an interest that users benefit from the site while spending as little time as possible on such it.
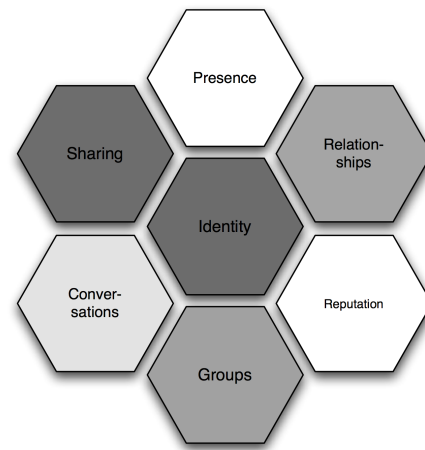

Figure 3: Analysis of the *esanet* internal social network according to the honeycomb framework for social media. The shades of grey indicate importance of the different building blocks (darker = stronger).

3.7. Site Evolution and User Adoption

Following the research results obtained by Katona et al. regarding the adoption decision of individuals based on network marketing techniques and the reported importance of word-of-mouth, a viral introduction strategy was used for the gradual introduction of *esanet*. [75] It also allowed to start with a site offering initially only very basic functionalities, and the gradual buildup of new, enhanced one based on user feedback and usage patterns.

The relatively simple setup mechanism offered by the underlying open source framework allowed to have a first alpha version online on November, 10 2011, a first test within a restricted 15 persons team starting 5 days later, and three weeks later the start of the beta-1 version with 80 colleagues spread over all sites. A limited number of users (15) were given privileges to invite others, which allowed the user base to grow within three weeks to 115 users.

Access is restricted to persons with an ESA email address and access to the ESA intranet. Users are accessing *esanet* with their normal standard corporate IT user names and passwords. *esanet* does not create additional databases nor requires the creation of user accounts, logins or passwords. Fig. 4 shows the evolution of the user-base of *esanet* during the first six months of the development, alpha and beta-testing phases.

The evolution of shared content on the site follows a similar patterns. All content is associated with the content creator. The only anonymous actions on the site are browsing and voting (participation to polls and expressing agreement or disagreement with statements in discussion fora).

Fig. 5 shows the evolution of content created by users. During the first six months of the introduction and testing phase, colleagues have created over 1000 such content entries. Status entries dominate posts, though following a major user interface re-design addressing among others this issue, the trend has been reversed. While the an effort has been made to make con-
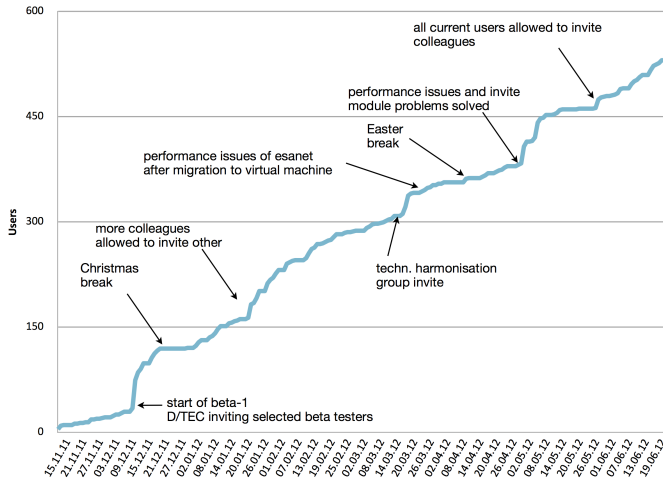
12
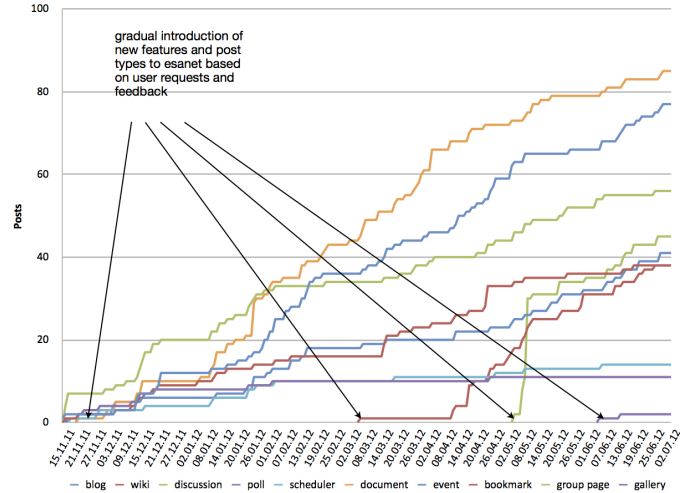
Figure 4: Evolution of the user base of *esanet*

Figure 6: Evolution of content created by users on *esanet*. The plot shows the effect of the introduction of a major update to the user interface, shifting the content creation from status updates to post creation.

tent creation simple, this process can still be improved, together with a more dynamic display of content.
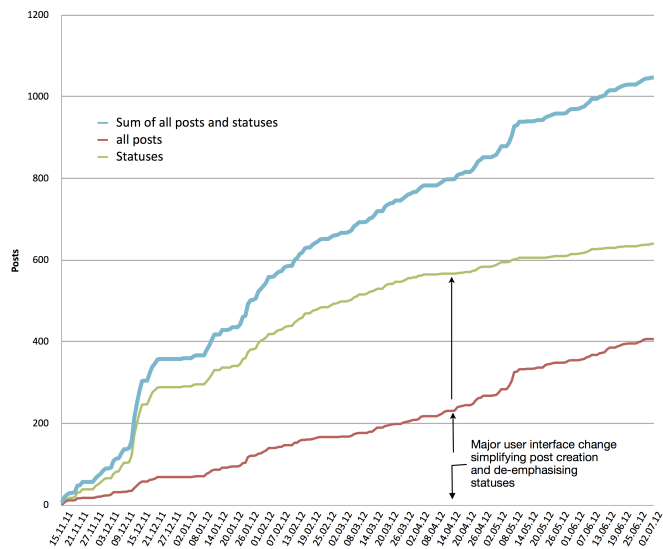

Figure 5: Evolution of content created by users on *esanet*. The plot shows the effect of the introduction of a major update to the user interface, shifting the content creation from status updates to post creation.

Fig. 6 shows the details of the types of posts users have created and shared on *esanet*. It also shows that some of the post types have been introduced gradually and relatively late in the process based on user requests. A good example are group pages, more static pages for groups which only administrators of the respective groups can create and edit to present the group.

There was no attempt to quantify the type of posts on *esanet* according to the different motivation areas of users as outlined in section 2.3. On a qualitative basis, and with the limitations inherent to alpha and beta-tester user perceptions when participating in the development of a tool, the user behaviour seems to match with the findings reported by DiMicco et al.: the *caring*

and *campaigning* aspects are much more prominent than posts than can be associated to *climbing* type behaviour. [23]

By September 2012, thus 9 months after the initial creation of the first alpha version of *esanet*, users have invited 1283 colleagues, of which 674 have joined. In total users created 556 unique posts (excluding the profiles), 781 comments to posts, 662 status posts and 311 comments to these. 78 unique groups have been created, which were joined by 321 users.

The large majority of groups are work-related technical and scientific groups (81%), though there are also interest, alumni and social groups (19%). 18% of the groups are declared as being specific to one site of ESA (though still accessible to users from all sites), 82% are declared by the group creator to be of general ESA-wide interest.

3.8. Site Governance Scheme

In order for *esanet* remaining a tool by users for users, and thus responsive to user needs, a dedicated governance scheme has been developed. All decisions regarding development directions, features, evolutions of the site are taken by an "*esanet* Governance Group".

This *esanet* Governance Group is composed of 1. regularly changing members, and 2. functional members. The regularly changing members are drawn from among *esanet* users by selecting in an automatic way the two most active users of the last month, the last three months and the last six months together with two randomly selected users. The later are added to prevent a "takeover" of the site governance by a few determined and very active persons who's needs might not be representative of the larger user community.

Functional members include the coders, persons hosting the hardware of the site and representative of different groups such as staff associations.

3.9. User feedback

Users started quickly to refer to it as this being "their" tool in the contributions on the site. Many users have also joined and actively participated in the open group on *esanet* dedicated to developing the site further. One of the ways how this has been achieved is that it was communicated and organised as a bottom-up, grass-roots initiative where all decisions where communicated and users consulted. Even the name was decided by users based on a poll on *esanet*. The general spirit of the site being a tool by employees for employees seems to be important for users.

While beta users have come from all hierarchical levels, the flat, open, democratic human-to-human approach seems to be generally appreciated. The adoption rate of such a very different, non-hierarchical way of communicating is dependent on the current working climate in the different organisational areas of ESA.

4. CONCLUSIONS

This paper reports on the potential of the use of private social network sites for space agencies. Based on an review of the scholarly literature on the use of social network sites in business and governmental organisations, an analysis of the key features and motivations for the use of such sites by organisations and users, this paper presents an analysis of the required specificities for such sites in space agencies. While there are many similarities in the use patterns and the motivation of users, there are also some striking differences. Internal social network sites need to fit within a tool set of organisations, comply with requirements and *in fine* help directly or indirectly to improve the organisations effectiveness to reach its objectives. Given that commercial public network sites are mainly advertisement sponsored, their design ultimately needs to optimise this revenue stream which leads to properties undesired for internal social network sites, such as e.g. long user remain times on sites. Internal social network sites on the other hand need to aim at minimising the time users need to spend on it to benefit from it for their specific tasks. We then report the results of the introduction of an internal social network site at ESA, including technical, organisational and management choices and present a summary analysis of the adoption by users during the first six months of its development and testing phase.

Using a theoretical framework based on seven functional blocks, the focus of the site is on *identity*, and *sharing*, followed by *groups* and *relationships*. *Conversation*, *reputation* and *presence* are not emphasised.

The paper also demonstrates that thanks to the use of readily available open source tools, it is possible to introduce with minimal effort an internal social network site in a large public organisation within only weeks of initial inception, and develop such a site relying largely on grass-roots, bottom-up initiatives from simple basic features to a tool valued and needed by users within half a year.

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