The Web 2.0 Internet: Democratized internet collaborations in the healthcare sector

By

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Abstract

Democratized internet collaborations, referring to participatory online tools or Web 2.0, now impact many aspects of people's lives. Scholars note Web 2.0's potential to improve eLearning or healthcare, and its ongoing impact in sectors such as tech-media. They also raise a plethora of important questions for practitioners and scholars, such as the criticism of Web 2.0 as hype or marketing term, which necessitates some determination of the scope and nature of Web 2.0. This holds equally for Web 2.0's use in health care, denoted as Medicine 2.0 or Health 2.0. Moreover, given the risks of people using user-generated content for health decisions, and its unproven effectiveness as a health policy tool, scholars have called for best practice models of use. This thesis addresses these fundamental issues, in a field that is fast moving, behind actual practice, and that requires concerted inter-disciplinary research. Therefore, this thesis incorporates seven distinct works that provide broad perspectives on the use of online collaboration tools in healthcare, each analyzing a specific topic in enough depth to remain relevant in a fast moving field.

These works include an examination of (1) Web 2.0 and (2) Medicine 2.0, using content analysis of millions of online conversations to surface the major practical or theoretical issues and tensions that underpin each concept. Two further studies examine (3) how and why doctors use Web 2.0 tools, and (4) how doctors search or forage for information in this evolving internet environment. These two studies rely on surveys, diaries and interviews from doctors working in the UK's National Health Service (NHS). Both highlight important results, such as models for Medicine 2.0 use, or make important contributions to literature such as connecting the previously separate cognitive online search and internet information judgment literatures. Three further studies examine Web 2.0 from an organizational perspective, including (5) design patterns of Web 2.0's use in global Pharma, which details best practice models of use and its clear link to Open Source design patterns, and (6) global Pharma's Open Innovation strategies, where online collaboration tools enable these strategies. The latter two studies employ interviews with 120 pharmaceutical executives analyzed through thematic analysis. They make major contributions to literature by characterizing open innovation strategies and gleaning implications for Absorptive Capacity in the Open Innovation context. The final study (7) examines Medicine 2.0 form the perspective of health service providers, informing management using eHealth as an instrument for improved healthcare management.

Overall, there are many major contributions to literature, which together achieve both a broad overview of Web 2.0 in healthcare, but also make specific additions to literature encompassing information systems, information science, medical informatics, and open innovation and strategy.

Publications

This work encompasses the following publications or conference presentations.

1. Hughes, B. Wareham, J. 2009. What is Web 2.0, and what's not: A road map for research relevance. *European Academy of Management, 10-14 May, Liverpool, UK & ECIS Doctoral Consortium 5-7 June, Verona.*

2. Hughes, B., Joshi, I., Wareham, J. 2008. Health 2.0 and Medicine 2.0: tensions and controversies in the field. *Journal of Medical Internet Research, 2008; 10(3):e23.* ***(2008 Impact factor 3.6; 6 citations)***

3. Hughes, B., Joshi, I., Lemonde, H., Wareham, J. 2009. Junior physician's use of Web 2.0 for information seeking and medical education: a qualitative study. *International Journal of Medical Informatics. 78, 645-655* ***(2008 Impact factor 2.9; 2 citations)***

4. Hughes, B., Wareham, J, Joshi, I. Doctors' online information needs, cognitive search strategies and judgments of information quality and cognitive authority: How predictive judgments introduce bias into cognitive search models. *Journal of the American Society of Information Science and Technology, in press.* ***(2008 Impact Factor 2.0)***

5. Hughes, B., Wareham, J. 2008. Democratized Collaboration in Big Pharma. *Academy of Management Conference, August 8-13, Anaheim, CA.*

6. Hughes, B., Wareham, J. 2009. Knowledge Arbitrage in Global Pharma: a synthetic view of Absorptive Capacity and Open Innovation. *R&D Management, forthcoming.* ***(2008 Impact factor 2.2)***

7. Hughes, B. Managing e-Health in the Age of Web 2.0: The Impact on e-Health Evaluation. In *Mohammed, S., & Fiaidhi, J. (editors) Ubiquitous Health and Medical Informatics: The Ubiquity 2.0 Trend and Beyond, forthcoming.*

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Preface

This thesis touches a wide range of topics and targets diverse audiences, as an attempt to view an amorphous and wide reaching topic such as Web 2.0 through a single lens would provide little insight. While embracing diversity, the clear theme of Web 2.0 and collaborative online tools in healthcare, and the environment in which these tools are used, drives each individual piece of work. For example, paper six details an open innovation strategy for a pharmaceutical company involving large forums engaging patients and doctors in early product development. However, this company's open innovation initiative, taken through the lens of the participating doctors and patients that the company sought as participants, is also Web 2.0 use at the individual's level. Hence, a reader embracing this thesis end to end will gain many deep perspectives on a fast moving but wide ranging topic, but can also examine each chapter individually as a self-contained piece of work unaltered from its particular publication.

I consider myself lucky to have had such exposure to a fascinating topic. Before my studies I became aware of the power of such tools working at McKinsey and Accenture, where I helped companies adopt them, and worked on seminal open source projects such as Linux and Apache. For example, I was involved in the launch of an internal wiki-based knowledge management system, and witnessed 10,000 articles written by staff in the first year alone. I also attempted to use Web 2.0 in research, through launching a wiki site for ESADE's PhD program, assisting in the development of ESADE's eLearning platform, and by working for the British Medical Journal to deliver editorial material and develop in their interactive doctor site. Certain of my own personal uses produced very interesting results, such as when I created a "Health 2.0" entry in Wikipedia in January 2008. Other people's edits immediately introduced me to relevant literature on such a burgeoning topic, and almost 100 revisions later, the article continues to improve. Moreover it has become one of my most important legacies, being first in any Google search on Health or Medicine 2.0, but also immediately introducing any reader to the work contained in this thesis (see annex 0 for page details).

It is evident that I am passionate about the strong proponent of collaboration using Web 2.0, though I remain critical of the term as Chapter 1 will reveal. Nevertheless, given the dearth of realistic alternatives that encapsulate this array of participatory or democratized collaborative tools, I am certain that Web 2.0 and Medicine 2.0's influence will continue to grow.

Introduction

The impact of Web 2.0 and its importance to healthcare and research

In its simplest interpretation, Web 2.0 is associated with online tools such as social networks, wikis, RSS feeds or blogs just to name a few (O'Reilly, 2005). Though these are all fairly recent phenomena, many people are familiar with the most famous incarnations of these tools, such as Facebook and Wikipedia. Overall, the impact of such tools on the online world is startling. For instance, the popularity of online social networks is continuously increasing: in May 2009, the total number of users in the top five combined (Myspace, Facebook, hi5, Friendster and Orkut) was 791 million people. Facebook is one of the most important of these sites with at least 200 million users, of which more than half active users returning. It is also the fourth most visited website on the Internet. (Gjoka, Kurant, Butts & Markopoulou, 2009), and over 85% of college students have a Facebook account. These trends are spectacular given that Web 2.0 only emerged in 2004. Wikipedia, an online encyclopedia written by voluntary users, is now also one of the top ten Internet domains in terms of Internet traffic. Even as long ago as 2007, over a third of Internet users in the United States had consulted Wikipedia, and almost 10% were consulting it every day (Rainie & Tancer, 2007). It continues to grow in size and out-strips all other encyclopedias in size and coverage, and it is estimated that 50% of doctors refer to Wikipedia for clinical references. Its English language articles alone are 10 times the size of the Encyclopedia Britannica, its nearest rival (Medelyan, Milnea, Legga & Wittena, 2009). Moreover, these trends are not confined to individual use, and recent surveys show that 80% of companies have a Web 2.0 strategy or are using their associated tools, and 42% see it as a source of competitive advantage (Bughin, Manyika, 2007).

The impact of Web 2.0 therefore extends beyond social amusement, and is particularly noted the areas of eLearning and eHealth, but also in certain industry segments such as Tech-Media (Hughes, Wareham, 2009). Web 2.0's application in these areas are not surprising, due to Tech-Media's close association with the internet and use of digital content, or in healthcare when it is noted that over 90% of US adults have searched for health information online (Ferguson, 2007). In eLearning, scholars have already claimed that sites such as Google and Wikipedia are becoming the dominant learning tools for this generation (Dron, 2007).

Of these three, the focus of this thesis is its application in healthcare, as well as the general use of online collaborative tools in the sector. Healthcare is among the fastest-growing sectors in developed economies, and is facing ever increasing patient expectation for health care services with limited resources (Cabrera, Burgelman, Boden, da Costa, & Rodriguez, 2004).

In this domain eHealth, referring to health services and information delivered or enhanced through the Internet and related technologies (Eysenbach, 2001), is a trend that potentially meets these challenges. As a relatively recent concept, e-health has yet to reach its full potential (Wickramasinghe et al., 2005). Web 2.0's application to eHealth is often denoted Medicine 2.0 or Health 2.0, and scholars note its potential to fulfill part of eHealth's promise in improving medicine or health care promotion (e.g., Guistini, 2006; McLean, Richards & Wardman, 2007; Sandars & Schroter, 2007; Boulos & Wheeler, 2007; Sandars & Haythornthwaite, 2007). This said, a number of risks have been identified with Medicine 2.0's emergence, such as issues of information privacy or the risk of use of inaccurate information (Hughes, Joshi, Wareham, 2008). For these reasons, a multitude of scholars have called for more research to develop best practice models of use (e.g., Dron, 2007; Lankes et al., 2008; Boulos & Wheeler, 2007; Karkalis & Koutsouris, 2006; McLean, Richards & Wardman; 2006; Beer & Burrows, 2007 – to name a few). It is indisputable therefore that these trends are of practical interest, and given their recent emergence, a critical area for research.

However, research into Web 2.0 faces major challenges associated with is definition, where there is both confusion in both practice and research arising from its unclear cope and delineation with the internet in general. O'Reilly (2005), who originally coined the term, notes Web 2.0's principal characteristics, including: a) data sources that get richer as more people use them, b) harnessing collective intelligence, or c) levering the "long tail" through customer self service. Furthermore, O'Reilly defined a set of typical tools for Web 2.0, including Wikis, RSS feeds, Web services, Mashups or Social Networking tools. It is this understanding that is often used in both practice and research. However, critics claim that Web 2.0 "*resists definition, either because the concept is too amorphous to have any real meaning, or because the underlying phenomenon is so huge and important that it defies any attempt to pin it down*" (McFredries, 2006). Overall this leads to much ambiguity, but the phenomenon still warrants attention by research for three reasons. Firstly, the term is entering the academic discourse, with over 200 publications associated with "Web 2.0" on the ISI web of science as of mid 2009. Secondly, there is substantial research interest into Web 2.0, with dozens of recent or future calls for papers from peer-reviewed journals embracing the subject. Finally there is the sheer online activity identified with the term, such as observers' estimates that the top 20 Web 2.0 sites (e.g., Facebook, Wikipedia or Craigslist) now account for 1 in 10 U.S. internet visits (Hopkins, 2008), or the 50 to 250 million references to the concept online (depending on the search engine used).

This massive volume of internet activity highlights a challenge for research. Where practitioners have examined Web 2.0 extensively, research has latently followed, as referenced by scholars who note Web 2.0 as a "*process of cultural digitization that is moving*

faster than our ability to analyze it… [there is] little systematic research" (Beer & Burrows, 2007). Moreover, closing a research/practice gap may require a marriage of information and organizational scientists in order to understand a phenomenon that is both technological *and* social (Boulos & Wheeler, 2007; Zammuto et al., 2007; Parameswaran & Whinston, 2008).

As a consequence, this thesis attempts to address this poor delineation of Web 2.0 and Medicine 2.0, advance best practice models for its use in healthcare, and use cross-disciplinary research to connect the emerging Web 2.0 field to other areas of research. However in its entirety it does much more than that, also making contributions to diverse fields such as Open Innovation, Strategy, and Information Science.

In the remainder of this introduction, rather than provide a literature review on Web 2.0, I will only define some basic terms for two reasons. First, studies #1 and #2 provide deep analysis of the Web 2.0 and Medicine 2.0 literature, and hence any such section on the introduction would introduce significant repetition. Where specific topics are introduced, such as cognitive search models in study #4 a full review of the research field is provided in each case (e.g., ***all 43*** relevant empirical studies to date are summarized). Following this basic terminology, the next section will make a comparison of the different studies contained herein, in terms of their macro-approach and units of analysis, the literature field and research gaps addressed the study designs, and the links between the studies. Given the diversity of the literature fields addressed, rather than summarizing the studies (a summary that can easily be accessed through their abstracts), much effort is made exploring the relationships between them.

Key concepts and terms

Web 2.0	A series of online tools (such as wikis, social networking sites, RSS feeds, peer to peer applications, etc. that follow certain principal characteristics, including: a) data sources that get richer as more people use them, b) harnessing collective intelligence, or c) levering the "long tail" through customer self service (O'Reilly, 2005).

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synonymous with

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	Democratized collaborations via open and participatory web-based tools, which act as an adaptive technical and social system in which individuals have a relationship with Web 2.0 artifacts (Hughes, Wareham, 2009)
eHealth	The intersection of medical informatics, public health and business, referring to health services and information delivered or enhanced through the Internet and related technologies (Eysenbach, 2001)
Medicine 2.0	The use of participatory Web (2.0) tools using principles of open source, generation of content by users, and the power of networks in order to personalize health care, collaborate, and promote health education.
UGC	User generated content - various kinds of media content, publicly available, that are produced by end-users (Wikipedia, 2009a)
Cognitive search models	The study of how different detailed actions in internet search form high level patterns of behavior (Navarro-Prieto, Scaife, & Rogers, 1999; Thatcher, 2006; 2008).
Information judgments	Examines how users perceive criteria such as quality or authority during information retrieval (e.g., Rieh, 2002; Metzger, 2007)
TAM	Technology acceptance model, exploring attitude and behavioral intention to use technology via notions of ease of use and usefulness (Wixom and Todd, 2005)
WAM	Web acceptance model, an extension of technology acceptance models aiming to explain web adoption by users (e.g., Castañeda , Muñoz-Leiva, & Luque, 2007)
Open innovation	The opportunity to commercialize both internal and external ideas, and commercialize internal ideas externally (Chesbrough, 2003).
Absorptive capacity	Explaining the ability to capitalize on external technology (Cohen & Levinthal, 1990)
Blog	An informal online journal, usually reflecting the author's personal thoughts (Mclean, Richards & Wardman, 2007)
RSS feed	RSS: a service that allows users to be automatically notified of new content on a website of interest (Mclean, Richards & Wardman, 2007)
Social networking service	**An online service** focusing on building online communities of people who share interests and/or activities, or who are interested in exploring the interests and activities of others (Wikipedia, 2009b)
Wiki	Wiki: a set of web pages that can be easily edited by anyone who is allowed access.

Comparison of thesis studies

This section highlights the contributions of each study by demonstrating the differences and links between them, and how this addresses a broad range of topics relevant to the use of online collaborative tools in health care. Firstly, the different lenses used to examine this phenomenon are detailed, as four different units of analysis were examined to enrich the understanding of concepts such as Medicine 2.0, and avoiding the common bias towards individual level use seen in literature. These lenses naturally invoked diverse literature bases and research objectives, and the contributions of each study vis-à-vis these fields are subsequently detailed. Following this, the different study designs are contrasted. Finally, the links between the studies are demonstrated, from a literary point of view, but also how the results of a specific study fed another. For the sake of brevity, the different research papers will be denoted by their numbers only (e.g., #1, #2, etc.).

Analytical lens and object of focus

While Web 2.0 and online collaboration tools in healthcare are the primary thesis focus, the phenomenon are understood via four types of lens or unit of analysis. For studies #1-3 and 5, the Web 2.0 concept and its manifestation through specific internet sites is examined, with papers #1-3 use the lens of individual level use. For example, study #2 suggests certain key tensions characterized is application to healthcare, Medicine 2.0 (Hughes, Joshi, Wareham, 2008), including the loss of control over information as perceived by doctors, the safety issues of inaccurate information online, and ownership and privacy issues with the growing body of information created by Medicine 2.0. All of these issues manifest in Medicine 2.0's use by individuals. In study #3 this focus continues, via an examination of doctor's use of Web 2.0 tools for clinical practice.

Figure A. Level of analysis of each study

In contrast, study #4 does not primarily examine Web 2.0, but rather focuses on general online information seeking behavior by medical practitioners, where user generated Web 2.0 content is highlighted within a doctor's overall cognitive model of online search. Study #5 brings the focus back to Web 2.0, but changes the focus from individual use to organizational level use. It specifically looks at the design criteria that management would need to consider to create a successful Web 2.0 system. Finally, studies #6 and 7# both examine organizational perspectives of different concepts related to Web 2.0. Specifically, study #6 focuses on open innovation strategy, where Web 2.0 and online collaboration tools in general are simply noted as a critical enabler for this strategy. While still at the same level of analysis, study #7 looks at eHealth in general, incorporating Medicine 2.0's impact into recommendations for policy management and eHealth evaluation.

Literary approach and contributions

Given the ambiguity with Web 2.0, this series of papers must begin with a critical examination of what this field is, and paper #1 looks at the definitions and boundaries of Web 2.0. It embeds itself in literature incorporating Social Computing (Parameswaran & Whinston, 2008), Online Communities (Armstrong & Hagel 1996) and Internet Ethics (e.g., Sama & Shoaf, 2002), and thereby mainly targets an Information Systems audience. Its results

suggests that Web 2.0 can be described as *democratized collaborations via open and participatory web-based tools, which act as an adaptive technical and social system in which individuals have a relationship with Web 2.0 artifacts*. As will be demonstrated later on, this definition significantly narrows the scope of Web 2.0. It excludes tools such as Google, which often associated with it but make its scope overly amorphous. The paper's contribution therefore is to allow a serious considerations of Web 2.0 as a research field, as up to this point in time research has used the term in a conflicting and confusing manner, that occasionally allows important existing literature to be ignored when developing Web 2.0 research.

In a similar manner to the above, Table 1 describes the respective objectives, literature bases, and contributions to literature that comprise these separate works. Many similar major contributions are made by other studies, including study: #2, that provides a comprehensive definition of Medicine 2.0 and an exhaustive review of the field; #3, that addresses both the research gap on doctor's perspective on the internet and their use of Web 2.0 tools, detailing best practice models of use; #4, that provides the much needed link between cognitive search and information judgment literature; #5, that responds to calls to further detail the success or design criteria of online communities; #6, that responds to call to study Open Innovation outside of the U.S. and tech-media, providing a reconceptualization of absorptive capacity, and ; #7, that provides a detailed practice and research program for improving eHealth evaluation in the context of the emergence of Medicine 2.0. Moreover, each paper targets a specific audience and an appropriate but distinct literature base. Within each respective stream of literature, these studies also respond to specific calls for research with that field. These are summarized in Table 1, with the objective, the research framework that situates the study in literature, the principal audience, and the rationale or contribution for completing the study.

Table A. Overview of separate studies composing this dissertation

#	Objective	Research Framework	Audience	Contribution
1	Define Web 2.0 and the issues unique to it	Social computing (Parameswaran & Whinston, 2008), online communities (Armstrong & Hagel 1996), internet ethics (e.g., Sama & Shoaf, 2002)	• Information systems/science	Addresses authors' recommendations to scope Web 2.0 (e.g., McFredries, 2006) and allows a clearly delineated Web 2.0 to studied alongside other research field
2	Define Medicine 2.0, and identify the major issues with its emergence	eHealth (Eysenbach, 2001) and Medicine 2.0 (Giustini, 2006)	• Medical informatics • Information systems/science	Responds to scholars' calls to define and identify issues with Medicine 2.0 (e.g., Skiba 2006; McLean, Richards & Wardman, 2007)
3	Determine what Web 2.0 tools are used by doctors, and for what purposes	Medicine 2.0 (Hughes, Joshi, Wareham, 2008) and doctors internet use and medical education (e.g., Masters, 2008)	• Medical Informatics • Information systems/science	Examines the research gap into doctor's perspectives on the evolving internet (Podichetty, et al., 2006) and provides models of Medicine 2.0 use
4	Examine how do doctors search and retrieve information online, in a Medicine 2.0 environment	Information systems literature on cognitive search models (Thatcher, 2008) or Information judgments (Rieh, 2002)	• Medical Informatics • Information science	Addresses calls to examine the impact of information judgments on search (Rieh, 2002; Griffiths & Brophy 2005; Browne, Pitts & Wetherbe, 2007), linking fields in a combined model
5	Determine design patterns in Pharma's democratized collaborations (Web 2.0)	Open source (Raymond, 1999) or distributed innovation sys. (Fischer & Giaccardi, 2007; Baldwin & Clark, 2005)	• Information systems	Responds to authors' calls to define design criteria important for successful community building (Raymond, 1999), providing a range of criteria that describe designs
6	Examine the context of Web 2.0 use via a related concept, open innovation, in Pharma	Open innovation (Chesbrough, 2003). Absorptive capacity (Cohen & Levinthal, 1990)	• Open Innovation • Information systems • Strategy	Enlarges case studies outside tech-media/U.S. (Chesbrough, et al., 2005), details best management practices (West, 2003), and provides an reconceptualization of Absorptive capacity for Open Innovation
7	Examine the impact of Medicine 2.0 on eHealth management	eHealth evaluation Frameworks (e.g., Murray & Frenk, 2000), Medicine 2.0, open source	• Medical informatics • Health policy makers/managers	Respond to scholars' calls to measure the impact of eHealth (e.g., Skiba 2006), incorporating Medicine 2.0's impact into evaluation designs

Study designs

Three major considerations impact the various study designs, the nascent state of the research field in general, the fact that research into Web 2.0 and eHealth use is far behind practice (Beer & Burrows, 2007; Potts, 2006), and the need to avoid the common method bias in internet research that orientates designs towards surveys or log files (Hargittai, 2002; Rieh, 2002). Firstly, the relatively nascent state of the field meant exploratory and naturalistic studies were favored. This drove a phenomenological enquiry that favored qualitative methods (Easterby-Smith, Thorpe &Lowe, 2002).

Secondly, there were two consequences of the practice/research gap. Given its size, we could not ignore practitioner viewpoints to examine the definition of both Web 2.0 and Medicine 2.0. In addition, the exploration of these topics required examining it through its related issues. This latter approach has been suggested by authors to constrain scope, close this gap, and promote a research agenda relevant to practice (Beer & Burrows, 2007; Potts, 2006; Amabile et al., 2001).

In considering the third point, common method bias, various procedures exist for examining online behaviors including log-files, screen recording devices, think aloud data (a major source of information on subject's cognitive processes), post-use interviews, or survey instruments amongst others (Hargittai, 2002; Rieh, 2002). In particular, scholars have observed that log files are useful for describing detailed patterns of use (or the what), but are not useful in describing choice behaviors (Rieh, 2001). While surveys are the predominant method of data collection in studying physician's internet use (Masters, 2008), limitations exist with it as well. This is partly due to the cost or effort required to achieve large samples, but mainly due to the difficulty of achieving deep behavioral insights from participant responses. This has led scholars to call for research beyond surveys and log files (Hargittai, 2002; Rieh, 2002), in particular examining the motivations of users online choices using mixed data collection methods (Metzger, 2007).

As a consequence, a number of different (and where possible mixed) methods were used across the studies. It should be noted that for study #5 and #6, the design was strongly dictated but the nature of the data set. The Pharmaceutical company in question provided unprecedented access to employees, from lower management level to C-level board members. However, restrictions where also in place necessitating non-intrusive designs such as the use of interviews and archival data.

The different samples, data collection instruments and analysis methods are summarized in figure B below, where black spots indicate that that particular device was used for the specific study. For example, study #3 used a sample of 35 doctors and 444 real online search incidents, data was collected using surveys, diaries and interviews, and was analyzed with thematic analysis.

Study	Sample	Collection instruments					Analysis methods			
		Survey	Diary	Inter-view	Arch-ive	Ethno-graphy	Content/ Thematic	Grounded Theory	Compar-itative	Quantita-tive
1 What is Web 2.0?	· 20 leading online Web 2.0 articles				●		●			
	· 250 million online Web 2.0 articles				●		●			●
	· 3000 online press articles on Web 2.0				●		●		●	
2 Medicine 2.0: Tensions	· 22 leading online Medicine 2.0 articles				●		●			●
	· 2 million online Medicine 2.0 articles				●		●			
3 Doctors' use of Web 2.0	· 35 practicing medical doctors; 444 search incidents by practicing medical doctors	●	●	●			●			●
4 Doctors' online information search	· 35 practicing medical doctors; 444 search incidents by practicing medical doctors		●	●			●			
5 Democratized collaboration in Pharma	· 120 interviews with Pharma executives; 30 major strategy documents			●	●	●		●		
6 Knowledge Arbitrage in Pharma	· 120 interviews with Pharma executives; 30 major strategy documents			●	●	●		●		
7 Managing eHealth	· Case examples (theoretical study - no major empirical component)			●						

Most of the techniques listed in Figure B are self-evident, but those that are more unusual include:

- Diaries – these contained 5 days of recorded search incidents filled by participant online based on their daily internet use. These enabled the study of real online information seeking, rather than researcher defined tasks.

- Comparative analysis – refers to a basic comparison of a small set of cases to determine causal inferences (e.g., see Rihoux 2006). Its implementation in this study not complex and tends towards just a basic comparison of groups

- Grounded theory - For studies in #5 and #6 in particular we adopted a compromise between pre-ordinate research and the Straussian variant of grounded theory (Strauss & Corbin, 1998), using thematic analysis for both a priori and open code identification.

- Content/thematic analysis - other studies used content or thematic analysis in a similar manner, e.g., a priori and open coding, due to both the need to extend existing literature, but also explore alternative dimensions of relatively new phenomena

- Quantitative analysis – no complex statistical techniques were used, but simple inferences were made from large pieces of quantitative data (e.g., the term most associated with Web 2.0, the site most visited by doctors, etc.)

- Ethnography – the studies are enhanced by the researcher's first-hand observation of the developed of the strategies in the pharmaceutical company. No detailed ethnographic evaluation is performed, but results from grounded theory are supplemented with the researcher's own perspectives of managerial attitudes towards the strategy setting exercise.

It should be noted that certain studies were coupled, sharing the same data collection or dominant analysis technique. Study #1 and #2 employ a content analysis of the whole public internet, though with major differences in sample or the internet sites analyzed. In addition, a longitudinal analysis of internet pages is used in study #1 and not in #2. Similarly, papers #3 and #4 use the same sample and share the same diary/interview data, though an additional survey was used to derive the results for study #3. For #5 and #6 the data collection and analysis techniques are more or less identical (though clearly differ in terms of the question asked of the data).

Overall the thesis is therefore entirely naturalistic, observing phenomena such as Web 2.0, online collaboration tools, information seeking and open innovation strategy in context. It is also highly geared towards exploratory research and the use of content analysis. While other techniques such as experimental or confirmatory approaches have many advantages, these
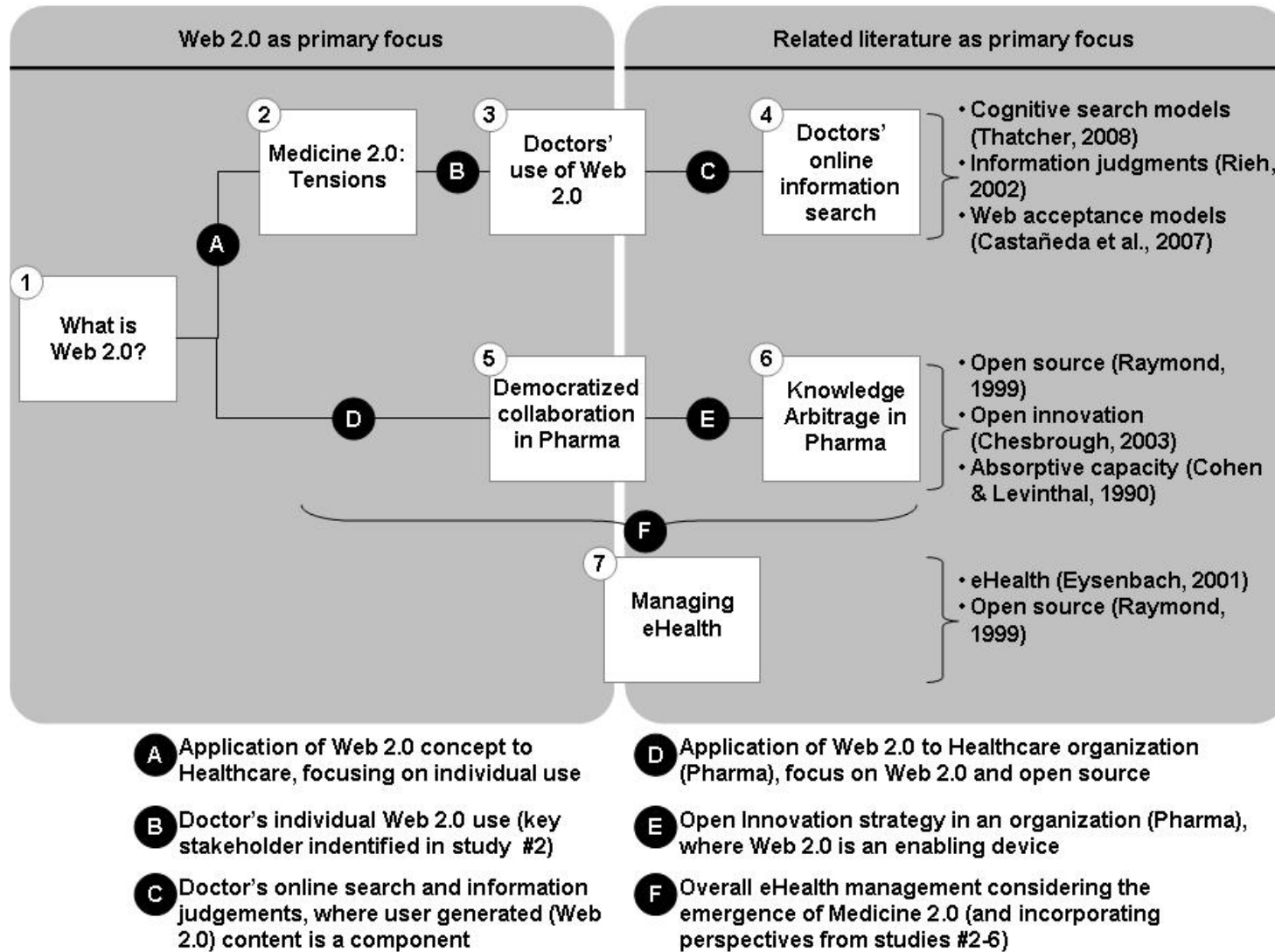
choices maximized the contributions to the targeted literature in each case. It also enabled the linking of Web 2.0 study to other existing research fields, a major requirement of any serious scholarly consideration of the subject.

Relationships between the studies (their literature and results)

Paper #1 poses 3 initial questions, to identify the major salient themes found online that define Web 2.0, the major issues identified with its emergence, and the aspects of these issues are specific to Web 2.0. It identifies the major issues associated with the mergence of Web 2.0, such as externalities of the transparency, and details where specific research fields (Internet design and semantics, eLearning, eHealth etc.) have identified and begun to consider them. More importantly, the paper suggests a definition of Web 2.0 as democratized collaborations via open and participatory web-based tools, where users have instrumental relationships with web artifacts that change their agency. There is a major difference in this proposal compared to previous definitions, considering the emphasis on democratized and participatory online activities rather than specific tools, and identifying a relationship with or change in agency from a Web 2.0 internet artifact. This concurs with some authors have described Web 2.0 as an attitude not a technology (Lin, 2007), and also shows the weakness of the tools based view of Web 2.0. Sites and technologies in O'Reilly's (2005) definition, like the peer-peer file sharing site Napster, now receive less attention than newer social networking sites like Facebook or MySpace. Furthermore, this definition required an exclusion list to clarify Web 2.0 use, such as email which is clearly also participatory. This confusing definition has led ubiquitous tools such as Google to being described as the quintessential Web 2.0 company (Giustini, 2006), and given Google's extensive use, this would suggest that Web 2.0 and the internet are synonymous. Hence, this definition clearly delineates Web 2.0 the Internet in general, from other areas of research, and also addresses the dilemma of understanding what constitutes a Web 2.0 tool that bedeviled previous Web 2.0 definitions. Web 2.0 research is separate to the study of online information systems without clear examination of this relationship, even if examining typical tools associated with the term are observed. Consequently, Web 2.0 is separate to research into very closely related areas such as Online Communities (e.g., Armstrong & Hagel, 1996; Balasubramanium & Mahajan, 2001). This research presumes user cooperation, not required for Web 2.0 systems, and may not focus on the user's relationship with the internet object. Overall these results provide a clear positioning of Web 2.0 as a research field amongst a plethora of closely related internet literature.

The next paper extends this analysis from the general construct to its specific application to healthcare, denoted as Medicine 2.0, and is one of the major uses and research areas for Web 2.0 in general. This is shown in figure C by the link marked A.

Figure C. Topic connections between the studies

Web 2.0 as primary focus | Related literature as primary focus

2 Medicine 2.0: Tensions

3 Doctors' use of Web 2.0

4 Doctors' online information search
- Cognitive search models (Thatcher, 2008)
- Information judgments (Rieh, 2002)
- Web acceptance models (Castañeda et al., 2007)

1 What is Web 2.0?

5 Democratized collaboration in Pharma

6 Knowledge Arbitrage in Pharma
- Open source (Raymond, 1999)
- Open innovation (Chesbrough, 2003)
- Absorptive capacity (Cohen & Levinthal, 1990)

7 Managing eHealth
- eHealth (Eysenbach, 2001)
- Open source (Raymond, 1999)

A Application of Web 2.0 concept to Healthcare, focusing on individual use

B Doctor's individual Web 2.0 use (key stakeholder indentified in study #2)

C Doctor's online search and information judgements, where user generated (Web 2.0) content is a component

D Application of Web 2.0 to Healthcare organization (Pharma), focus on Web 2.0 and open source

E Open Innovation strategy in an organization (Pharma), where Web 2.0 is an enabling device

F Overall eHealth management considering the emergence of Medicine 2.0 (and incorporating perspectives from studies #2-6)

Paper #2 examines Medicine 2.0's scope and definition, similarly to Web 2.0, as the term has also been associated with hype than a real change in internet use for health (Skiba, 2006). The paper crosses the boundary of many research disciplines, but mainly relies on Medical Informatics and Information systems literatures. It is distinguished from previous reviews, in that earlier studies mainly introduced specific Medicine 2.0 tools, which also would be inconsistent with the result found in paper #1 (that a tools based approach is not appropriate). In addition to addressing the field's definition via content analysis of vast online data, it establishes a literature base and delineates key topics for future research into Medicine 2.0, distinct to that of eHealth. Four major tensions or debates between stakeholders were found in this literature, including; (1) the lack of clear Medicine 2.0 scope, which the paper itself addresses; (2) tension due to the loss of control over information as perceived by doctors; (3) the safety issues of inaccurate information from user generated content, and; (4) ownership and privacy issues with the growing body of information created by Medicine 2.0. This paper naturally links to #3, as doctors are found to be one of the principal stakeholders in the most important tensions (2-4), and is shown by link B in figure C.

Hence, **paper #3** aims to address the lack of doctor's perspectives on the evolving Medicine 2.0 internet (see Podichetty, Booher, Whitfield & Biscup, 2006), in identifying which sites and for what purpose Web 2.0 is applied in medical practice. This paper is rooted in the medical informatics literature, where the use of online resources has been shown to generally improve physicians' clinical decisions (Wright, Bates, Middleton, Hongsermeier, Kashyap, Thomas &. Sittig, 2008), but the use of Google or Wikipedia in medicine has been met with controversy (Gardner, 2006: Lacrova, 2008). The study does not explore the extent of Web 2.0's use, which has been demonstrated by previous survey research (e.g., Manhattan Research LLC, 2007; Sandars & Schroter, 2007), but aims to understand how and why it is used in the clinical context. Derived from surveys, diaries and interviews completed with UK doctors, results indicate that 53% of their internet visits employed user-generated or Web 2.0 content, with Google and Wikipedia used by 80% and 70% of physicians, respectively. Despite awareness of information credibility risks with user generated content, it has a role in information seeking for both clinical decisions and medical education. Stated simply, doctors prefer user generated content for many information needs due to the breadth of content and ease of use of these sites. This is also enabled by the ability to cross check information and the diverse needs for background and non-verified information. Figure D neatly summarizes these results.

**Figure D – Motivators to use Web 2.0 or traditional medical sites.**
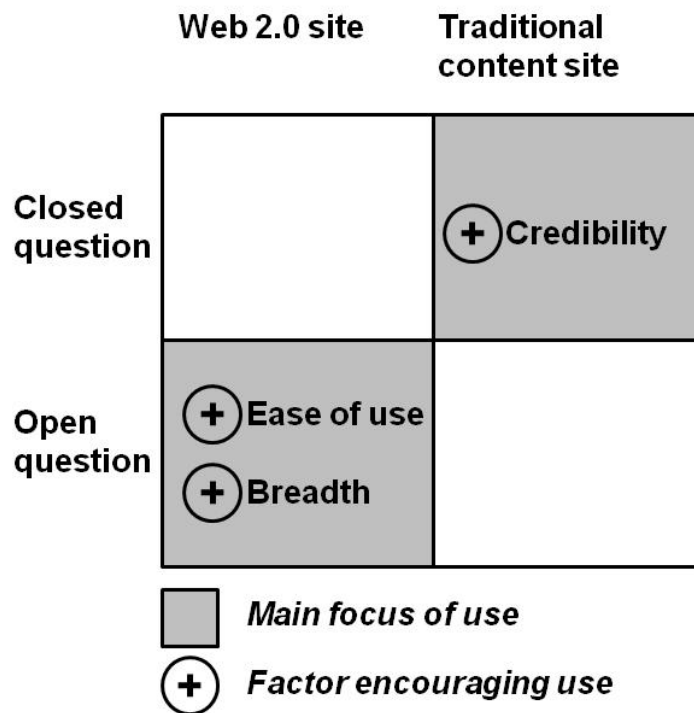
However in relation to the results of paper #1, few doctors participate in or contribute to Web 2.0 resources, and though a utility relationship was observed with certain sites classified as Web 2.0 resources, a change agency suggested by Study #1 could not be observed. Finally, results also supported the conclusions of paper #1, in that a number of tools could be excluded from Medicine 2.0's scope (e.g., Google), though many sites used were hybrid combinations of Web 2.0 user-generated content and traditional online resources.

The need to interpret the use of Medicine 2.0 sites via information credibility in study #3 naturally led to focus on judgments of online information and the associated information science literature (e.g., Rieh, 2002; Metzger, 2007). This is shown by arrow C, in figure C, leading to *paper #4.* This paper examines how doctors search for and judge online information in a context where the availability of user generated (Web 2.0) content influences this search, rather than a study of Web 2.0 itself. Embedded in the information science literature, the extensive fields of Cognitive search models (Navarro-Prieto, Scaife, & Rogers, 1999; Thatcher, 2006; 2008), which examines the cognitive aspects of the moves users employ to optimize their search performance, is combined with internet information judgments (e.g., Rieh, 2002; Griffiths & Brophy 2005). This latter literature examines how users perceive criteria such as quality or authority during information retrieval. Cognitive search models rarely explore the impact of predictive judgments, and this paper addresses a longstanding need to connect these two fields (Rieh, 2002; Browne et al., 2006). The study uses the real information search of UK doctors, with similar data collection methods to study #3, and in doing so also addresses the methods

bias towards researcher defined task in internet search literature (see Thatcher, 2006). Many important results are detailed, such as doctors' focus on information quality and cognitive authority via predictive judgments to resolve information needs before a document is accessed. These predictive judgments create inherent bias in all stages of cognitive search, including the identification of new cognitive strategy archetypes. The study is extremely innovative, as it notes how constructs from information judgment literature (predictive judgments, evaluative judgments, quality, cognitive authority etc.) mix with those in cognitive search (Web experience, mental models of the internet, task type etc.). A model is proposed, shown in Figure E, which demonstrates how the constructs in information judgment literature can be used to describe the influence on search strategy of constructs normally associated with cognitive search literature.

*Figure E. Cognitive internet search adapted for predictive and evaluative judgments*
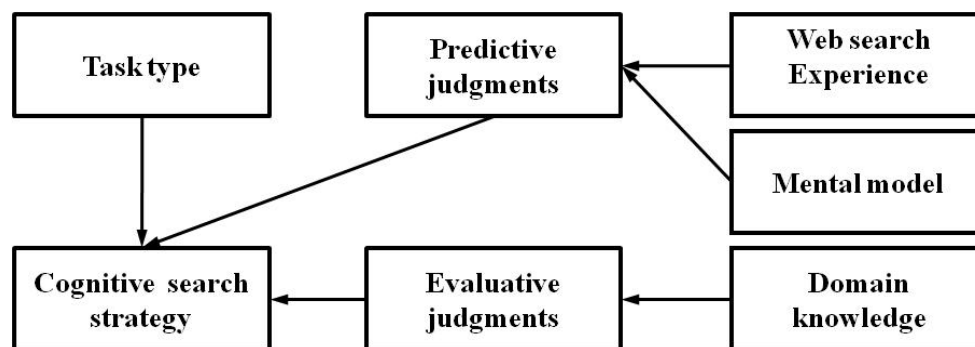
Finally, the paper speculates that the results of the study could enable enrichment with Web acceptance models or WAM (Castañeda, Muñoz-Leiva, & Luque, 2007) via the view of a network of different sites in a user's mental model and predictive judgments. As can be seen from figure C, in terms of studies this sits outside the realm of Web 2.0 research, but provides important links incorporating the concept to other research fields.

Following this, *study #5* repositions the thesis close to the Web 2.0 concept once more, examining its use by a major pharmaceutical company (link D in figure C). The company in question embarked on a major strategy exercise incorporating the use of internet technologies that can promote innovation. The study identifies design criteria for successful Web 2.0 or online collaborations that companies engage in. Literature into online communities suggests that structural design criteria are important for community building (Raymond, 1999), but offers few normative design principles for distributed innovation systems. Based on interviews with 120 pharmaceutical executives from a global Pharma company, results show that democratized collaborations (or Web 2.0 tools as understood by the company) clearly have the potential to add value to pharmaceutical industry. In addition, 9 structural design criteria are identified that need to be examined by managers when considering democratized collaboration design. A

number of commonalities found between this Pharma case and extant literature weighted on technology and media sectors, notably open source, suggest that a generalized framework might be possible. Overall these results move away from Web 2.0 analysis as described in study #1, and are complemented literature on online communities and open source (e.g., Fischer and Giaccardi, 2007; Baldwin & Clark 2005), which in turn supports other diverse topics such as Wikinomics (Tapscott & Williams, 2006) and Democratizing Innovation (von Hippel, 2005).

These commonalities with open source naturally begged a different question of the same data, to examine the Open Innovation (OI) strategy of this company in *study #6.* This paper examined the major OI strategy concepts frequently gleaned from open source, and examined their applicability to the innovation portfolio and strategy formulation in the same global Pharma company. Results from interviews showed that 5 out of 7 "major" concepts were applicable. It also concurred with authors about the role of technology in achieving any such strategy (see Dodgson, Gann & Salter, 2006), demonstrating that the technologies associated with Web 2.0 were more influential than in previous analyses. In addition, results indicated the existence of an outbound capability rarely examined literature, in a different direction across the firm boundary from absorptive capacity. Certain authors have suggested that an entirely new outbound capability should be considered (Gassmann & Enkel, 2004). However, this study notes that broad interpretation of the Absorptive Capacity construct can accommodate OI by taking a bi-directional view of 4 sub-concepts in its conceptualization (recognize value, acquire, assimilate and transform). This is shown in figure F below.

Figure F. Absorptive capacity in an open innovation context
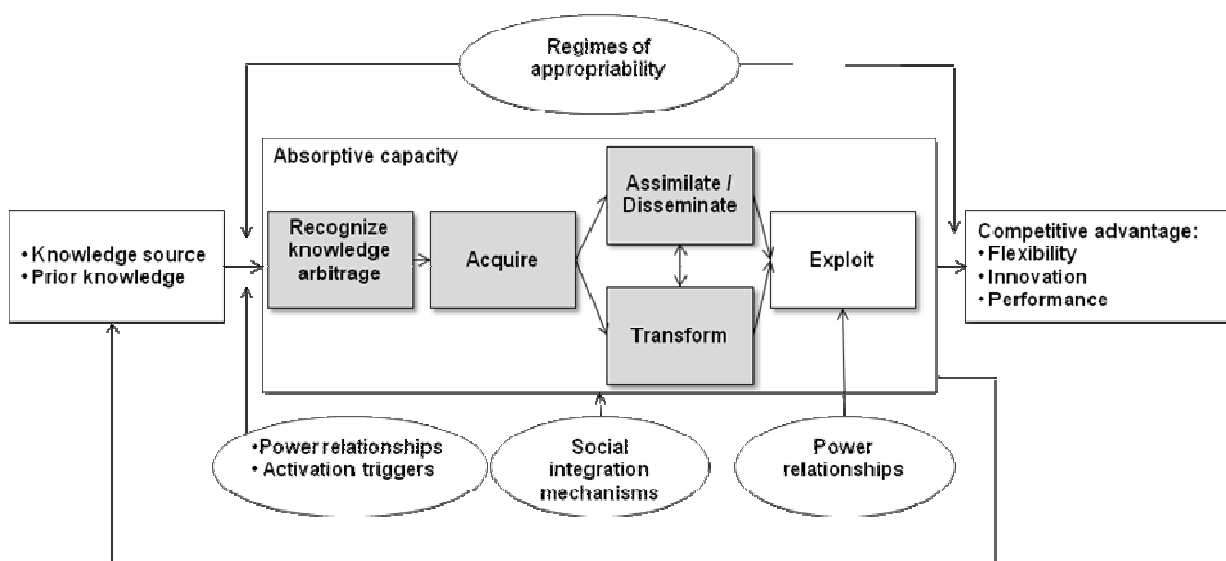
This in-depth study makes several contributions to the literature, addressing calls for research into OI across sectors (Chesbrough, Vanhaverberke & West, 2006), suggesting that its strategy should be viewed as a capability focusing on knowledge arbitrage in uncertain conditions, a view not prominent in literature. This responds to scholar's calls to detail the content of routines that drive innovation (Thomke, 1998; Chesbrough, et al. 2006), the need to link OI, capabilities and strategy (e.g., Gassmann & Enkel, 2004; Vanhaverbeke et al. 2008). Finally, this link from Web 2.0 to Open Innovation may seem surprising to those unfamiliar with the subject. However, sites such as Wikipedia have been noted to follow the Open Source model (Hendry, Jenkins & McCarthy, 2006), and it was this model through high profile case examples, such as Linux, that helped spawn the Open Innovation movement (see Chesbrough, 2003a). As such, authors have commented that in an "enterprise 2.0" context, where companies embrace Web 2.0 in strategy, any strategy must be interpreted both as the need to understand the opportunities from the underlying toolset, but also the need to embrace its open participatory nature through open innovation (Bughin, 2008). Hence, while this spans huge differences in literature sets, in the eyes of the practitioner, these are concepts that must go hand in hand for value creation.

Finally, *study #7* incorporates perspectives from studies #2-6 to enlighten policy on the broader topic of eHealth management. As marked in figure C, there are a number of links to the previous studied in the thesis. This theoretical paper addresses the issue that there is no established evaluation framework for eHealth, and that evaluation is centered on general ICT use in healthcare (Glasgow, 2007). Many of these evaluation frameworks consider impact through user uptake and satisfaction derived from the Technology Acceptance Model (TAM), exploring attitude and behavioral intention to use technology via TAM's notions of ease of use and usefulness (Wixom and Todd, 2005; Davis 1989). However, the participatory nature of

emerging Medicine 2.0 use identified in study #2, impacts greatly factors considered in TAM. Medicine 2.0 has developed new methods for engaging users, but is yet to be related to any improved patient outcomes. This therefore dovetails with study #4 in that some re-consideration of the use of TAM must be made, itself a natural consequence of technological surges tend to leave research and evaluation techniques far behind (Potts, 2006; Atienza, Hesse, Baker, Abrams, Rimer, Croyl & Volckmann, 2007). While an adaptation of WAM models may be considered as suggested in study #4, the main thrust of the argument is that intention to use a system in the age of Medicine 2.0 is no longer a viable basis for evaluating success. Investments must be directly related to outcomes, and Open Source investments paths must be considered when making these comparisons to outcomes.

A major case example used in the paper to demonstrate UK's IT program for the NHS, a now 20 GBP billion program to develop online Electronic Health Records. I used part of the argument of this final chapter online in April 2009, in stating that Web 2.0 and Open source principles must be considered to reduce the investment in achieving its goals (Hughes, 2009b). A major UK's political party, in July 2009, then adopted this as a policy mechanism of achieving the IT goals for health care system in general (Coates, 2009). This demonstrates the importance of the arguments in this final paper when applied to real life case examples. The paper concludes with proposal to frame eHealth evaluation in the context of Medicine 2.0, including potential delivery of Medicine 2.0 using open source principles detailed in study #5. It also details the role of research in achieving these goals, by extending studies beyond the single intervention, examining issues of transferability and scalability and, creating common frameworks for comparisons of eHealth effectiveness. Moreover, this final paper provides the broader perspective on the implications of Medicine 2.0's emergence, thereby serving as a conclusion to this thesis.

Overall an extensive review of Web 2.0 and its application to healthcare is covered in the thesis, incorporating the major related literature fields (eHealth, online communities, online search and information judgments, open source and open innovation). Though paper #7 serves as a concluding chapter, and incorporates important ideas and these fields from the other studies, there are few direct citations of these results in its publication. This is both a consequence of the fact that many of these works were completed in parallel, a decision taken due to the fast moving nature of the field (Beer & Burrows, 2007), and that many different audiences are addressed. This multi-field approach was a deliberate choice, as many scholars' have identified the need for interdisciplinary research combining information science and other organizational fields in order to understand a phenomenon that is both technological and social (Boulos & Wheeler, 2007; Zammuto et al., 2007; Parameswaran & Whinston, 2008). While this means that only 3-4 studies are core to Web 2.0 research, as denoted on the left had side of figure C, this

approach ensured that an understanding the phenomenon could be made through links to major research fields, such as capabilities and absorptive capacity in the field of strategy, to acceptance models for web use in information systems.

Research papers

1. What is Web 2.0?

Abstract

Web 2.0 is criticized as an unclear concept, but warrants attention due to its increasing presence across professional and popular practice. This paper aims to delineate the phenomenon, identify its salient themes, the issues associated with its emergent use, and how the major areas of Web 2.0 research examine these issues. To answer these questions, we use content analysis of the entire public internet, 2,877 online press articles, and a systematic review of Web 2.0 literature. The results suggest a definition of Web 2.0 as *democratized collaborations via open and participatory web-based tools, which act as an adaptive technical and social system in which individuals have a relationship with Web 2.0 artifacts.* This definition addresses previous issues in understanding Web 2.0 scope, delineates it from research areas such as online communities, and provides key issues to drive a research agenda relevant to Web 2.0's use.

Key words

Internet; Web 2.0; Social computing; Internet Ethics; IS Research; IS Research Issues

1.1 Introduction

Web 2.0 was popularized by the O'Reilly Media conference in 2004, representing a new philosophy of open participation and a second generation of web-based tools and communities that facilitate user collaboration (O'Reilly, 2005). Despite strong criticism of this concept as too amorphous (McFredries, 2006), it warrants attention by research for three reasons. Firstly, the term is entering the academic discourse, with 121 publications associated with "Web 2.0" on the ISI web of science as of late 2008. Secondly, there is substantial research interest into Web 2.0, with dozens of recent or future calls for papers from peer-reviewed journals embracing the subject. Thirdly, there is the sheer online activity identified with the term, such as observers' estimates that the top 20 Web 2.0 sites (e.g., Facebook, Wikipedia or Craigslist) now account for 1 in 10 U.S. internet visits (Hopkins, 2008), or the 50 to 250 million references to the concept online (depending on the search engine used).

This massive volume of internet activity highlights a challenge for research. Where practitioners have examined Web 2.0 extensively, research has latently followed, as referenced by scholars who note Web 2.0 as a *"process of cultural digitization that is moving faster than our ability to analyze it… [there is] little systematic research"* (Beer & Burrows, 2007). This observation is both generally applicable but equally relevant to specific areas of Web 2.0 research such as eHealth (or Medicine 2.0) where an issues-based research agenda is proposed to close this gap (Potts, 2006). Moreover, closing a research/practice gap may require a marriage of information and organizational scientists in order to understand a phenomenon that is both technological *and* social (Boulos & Wheeler, 2007; Zammuto et al., 2007; Parameswaran & Whinston, 2008). Hence, within this context of a poorly defined but quickly evolving subject, we pose the following research questions:

Research question 1: What are the salient themes found online that define Web 2.0?

Research question 2: What are the major issues identified with its emergent use?

Research question 3: What aspects of these issues are unique to Web 2.0?

To answer these questions we used multiple techniques. Question one utilizes Google's PageRank system to identify the most popular online discussions and delineate key themes through thematic analysis. The frequencies of use of these themes in relation to Web 2.0 were then established across all public internet sites. For question two, we examined 2,877 press articles on Web 2.0, identifying those that reported issues with its use. This approach is based on journalism's broad ability to publicly criticize and highlight issues in a proportionate manner (Kovach & Rosenstiel, 2001). To answer question 3, we used a comparative method to analogous (but non-web 2.0) situations to identify aspects of these issues specific to Web 2.0. We then examined literature to determine:

Research question 4: What are the major areas of Web 2.0 research?

Research question 5: Which of these issues are addressed by Web 2.0 research?

This paper makes four main contributions to the literature. Firstly, to our knowledge, this provides the first broad empirical-based Web 2.0 definition. We expose the internal conflicts in previous definitions, which arise from considering Web 2.0 as via a specific set of tools. Secondly, we identify a range of issues specific to Web 2.0, distinguishing it from general internet or media use. Thirdly, we provide a systematic review of Web 2.0 literature establishing that these issues are only partly addressed by both Web 2.0 and internet ethics research. Finally, in considering these results together, we highlight how the proposed definition addresses previous issues in understanding Web 2.0 scope (see McFredries, 2006). It delineates it from research areas such as online communities, and provides key issues to drive a research agenda

relevant to Web 2.0's use, addressing authors' calls for approaches for extensive and systematic research in this area (e.g., Beer & Burrows, 2007; Klamma et al., 2007; Wiberg, 2007).

1.2 Research framework

O'Reilly notes Web 2.0's principal characteristics, including: a) data sources that get richer as more people use them, b) harnessing collective intelligence, or c) levering the "long tail" through customer self service (O'Reilly, 2005). However, critics claim that Web 2.0 *resists definition, either because the concept is too amorphous to have any real meaning, or because the underlying phenomenon is so huge and important that it defies any attempt to pin it down*" (McFredries, 2006). Despite attempts to narrow the definition (O'Reilly, 2006), researchers and practitioners incorporate a wide variety of tools such as search (e.g., Google), Podcasts or RSS (see Giustini, 2006; Sandars & Schroter, 2007) into its scope. The weakness with this tools-based approach is exposed in examining the top 20 websites (see Meattle, 2007), all of which encompass some of these elements such as RSS feeds, posing the concern that Web 2.0 and the internet are synonymous.

Despite these concerns, Web 2.0 has become prominent in the discourse of practitioners across a wide variety of fields. Significant manifestations include Time magazine's 2006 person of the year "You" (Grossman, 2006), reflecting the collaborative power of the new web or Web 2.0, and derivations of the terms such as the Medicine 2.0 academic conference (Medicine 2.0 congress, 2008), Enterprise 2.0 (Davenport, 2008; Mcafee, 2006), or e-learning 2.0 (Downes, 2005).

Given its nascent and rapidly evolving character, academic literature is unlikely to have achieved consensus on Web 2.0's scope as quickly as 2009. Indeed, of the 121 publications found related to Web 2.0, none specifically attempt to resolve the term's unclear definition, instead using aspects suited to their research agenda. This growth in research into a concept across different literature, using slightly different interpretations of its meaning, could impede the clarity of further research. For this reason we address its definition, and seek an issues-based view of Web 2.0 following suggestions that this approach can constrain scope and promote a research agenda relevant to practice (Beer & Burrows, 2007; Potts, 2006; Amabile et al., 2001).

However, this approach must also take into account two areas of literature, previous work on online communities, and previous research in internet ethics field. Firstly, there has been extensive research into online communities or online social networks, such as the exploration of their value (Armstrong & Hagel, 1996; Balasubramanium & Mahajan, 2001), resource based views of their utility (Butler, 2001), the differences between traditional structures and online

communities and the consequences for research (Ward, 1999; Thomsen, Straubhaar, & Bolyard, 1998), or why people contribute to certain communities (Wasko & Faraj, 2005).

Secondly, in internet ethics, a focus of research has been e-commerce or new media ethics considering the responsibilities of organizations operating on the internet. Key themes explored include Security of Information, Intellectual Property Rights, Privacy and Informed Consent, Threats to Vulnerable Groups such as children, or Trust (Sama & Shoaf, 2002; Kracher & Corritore, 2004). These themes encompass significant issues, such as the behaviors associated with online piracy (Shang, Chen & Chen, 2008), using the internet for rational assisted suicide (Richard, Werth & Rogers, 2000), or trust issues in manipulation of online consumer or eHealth forums (Dellarocas, 2006; Chandra, 2004). Outside of e-commerce, researchers have also looked at the relativistic and moralistic issues of individuals using the internet including generational attitudes (Freestone & Mitchell, 2004) or workers attitudes to the internet at work (Lee, Seong & Jongheon, 2008; Langford, 1996). In addition, scholars have examined the ethics of completing research on online communities, with focus on consent (Eysenbach & Till, 2001) and bias (Moreno, Fost & Christakis, 2008). Finally, the new participatory web economy is noted for enabling faster change at greater scale, with less time for learning and ethical feedback (Argandona, 2003).

While, few of these studies are specifically positioned as Web 2.0 research, any examination of Web 2.0 needs to consider its relation to it.

1.3 Method

1.3.1 Using Web 2.0 to define itself

Online discussions defining Web 2.0 are extensive, and given the limited attention paid to its definition by research, were used to further understand its scope. Hence, extending a method used to define Medicine 2.0 and Health 2.0 (Hughes. Joshi, Wareham, 2008), we used a Google search for "Web 2.0" to analyze key online discussions and identify the term's salient themes via thematic analysis (Strauss & Corbin, 1998). Google was used based on the PageRank system that relies on the web's vast link structure to indicate an individual page's value. Google interprets a link from page A to B as a vote by page A for page B, weighted by the links to the page that casts the vote (Cho & Roy, 2004). However, PageRank creates a richer-get-richer phenomenon making it hard for new pages to be recognized. As such, Cho, Roy & Adams (2005) propose that page quality should be determined from absolute number of links and a relative change in links over a recent time period. In keeping with their proposal, two steps ensured results were not biased to a few highly linked pages. Firstly, the search engine's count feature was used to determine the frequency of use across all web pages, providing an absolute

ranking of a term. Secondly, the exercise was repeated after 6 months to provide a longitudinal view of the change in popularity, avoiding bias towards older terms.

This said, observers claim that Google's (and other search engines') count feature is unreliable at low counts (Vaughan & Thelwall, 2004; Notess, 2003). However, the fact that research has tried to expose the weaknesses of Google is one of three reasons to chose it, as: 1) research provides increased visibility into any bias to be avoided; 2) Google has less bias than other search engines examined (e.g. Thelwall, 2008), and; 3) as 57-66% of the total search market (Neilsen, 2008), it represents the content that a majority of internet users will find.

In addition, we also attempted to increase reliability by focusing on manifest codes or exact phrases found in the analyzed text, which scholars suggest produces high reliability (Hagelin, 1999). Pages were analyzed until saturation, or when new pages provided no further salient themes above those identified. We also contacted Google to understand search algorithm changes during the 6 month period, who described our approach as "*insensitive to [the] algorithmic changes*" (Personal correspondence, June 2008).

1.3.2 Identifying Web 2.0 issues through online press analysis

Scholars have examined the effectiveness of using online news in research, such as examining press for just a week (Hester & Dougall, 2007), or sampling the content for a particular online publication (Wang, 2006). While no consensus exists, studies suggest a minimum of 6 days to sample a newspaper (2% of year) to a maximum of 9 weeks for a weekly publication (17% of year). We took a compromise of a randomly generated sample of 30 days (8% of year) and ensured that saturation in content analysis was obtained.

Studies have compared the top news aggregators (Chowdhury & Landoni, 2006; Del Corso, Gulli & Romani, 2005), but results have focused mainly on usability rather than bias. However, Google News bias has been found to be lower than others (Ulken, 2005), driving its selection. All articles within the sample days identified via a search of "web 2.0" were read, and those containing detailed discussions on controversial issues were noted and categorized by the researchers.

1.3.3 Identifying issues specific to Web 2.0

To determine issues unique to Web 2.0 the same search engines research questions 1, 2, 4 and 5 were used (Google, Google news, ISI Web of science, Business source premier and pro-quest). An example issue from each of the Web 2.0 issue categories defined in question 2, and with "Web 2.0" absent from the search, identifying analogous examples of issues such as "child predators". The top ten results from each search tool were examined, and the most analogous discussion selected (e.g., the same topic focusing either on the general media or the internet before Web 2.0's emergence). The two issues were compared by researchers to highlight

manifestations of the problem that were specific to Web 2.0. Figure 1a summarizes the combined approaches for 1.3.3 and 1.3.4, relying the reliance on; 1) journalism's ability to publicly criticize and highlight issues in a proportionate manner (Kovach & Rosenstiel, 2001); 2) Google news, chosen based on lowest bias (Ulken, 2005), and; (3) sampling exceeding those in standard studies (see Hester & Dougall, 2007;Wang, 2006).

Figure 1a: Summary of method for identifying Web 2.0's unique issues
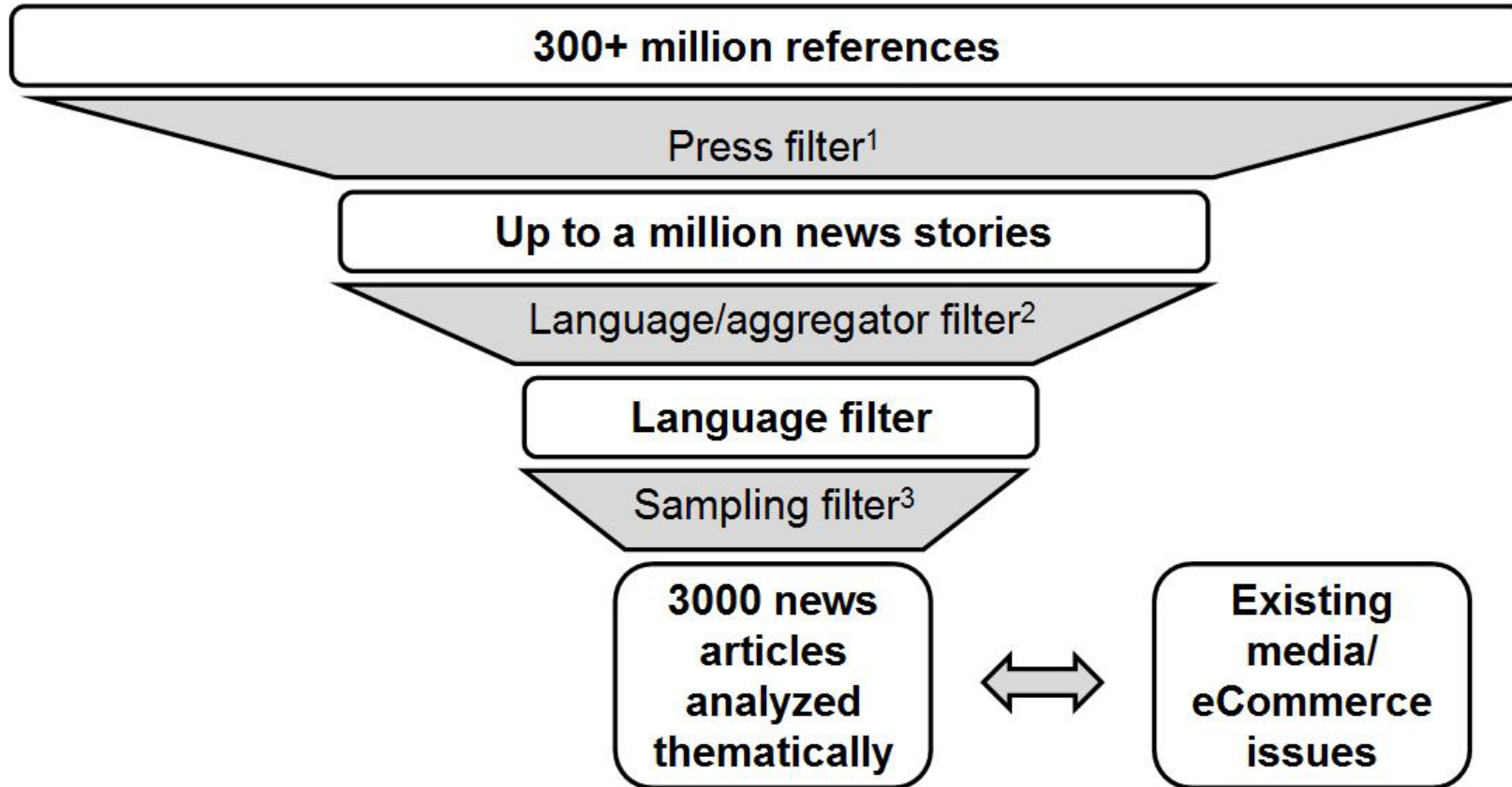
1. Based on journalism's ability to publicly criticize and highlight issues in a proportionate manner (Kovach & Rosenstiel, 2001)
2. Google news chosen based on lowest bias (Ulken, 2005)
3. Exceeding those in standard studies (see Hester & Dougall, 2007; Wang, 2006)

1.3.4-5 Examining Web 2.0 literature

We looked for peer-reviewed journal articles through the ISI web of science (121), Business source premier (94) and Pro-quest (52). While the figures in brackets indicate the number of articles found that matched the search term "Web 2.0", many are only short reviews or comments. For this reason, only articles that included empirical data or that performed extensive reviews offering new insights to Web 2.0 were included. This and removing duplicates led to a final total of 41 articles, which were reviewed by the researchers for their literary foundation and the key questions and issues addressed.

1.4. Results

In the following sections we provide only an overview of the extensive results found. An annex is available on request detailing all of the literature examined (online and research), more detailed descriptions of the issues found, and how literature addresses these issues.

1.4.1: What are the major salient themes found online that define Web 2.0?

12 articles were coded before saturation was obtained, but themes mainly derived from 7 articles (Wikipedia 2007,2008a; O'Reilly, 2005; Graham, 2005; Web 2.0 Workgroup, 2007; O'Reilly, 2006; Anderson, 2007; Web 2.0 summit, 2008). Open coding saw terms split into two main categories, observations of its objectives, benefits or methods, and the tools of Web 2.0. For objectives, benefits and methods, the following concepts were prominent: collaboration, participation, democracy, knowledge, collective intelligence, and learning. For tools, the most significant associations were blog, social bookmarking/tagging, open source/systems and wikis. This said, in the six month period social networking became significantly more important as a Web 2.0 tool. The seven most prominent terms are detailed in tables 1a and 1b, though over 100 were explored. Where there is a significant change in a term's ranking during the 6 month period, it is indicated in grey. These results led us to the definition of *Web 2.0 as democratized collaborations via open and participatory web-based tools.* Many different tools enable this, including blogs, social bookmarking, wikis or social networking.

Table 1a: Online references to Web 2.0 objectives, benefits or methods

Objective, benefit or method	June 2008	Dec. 2007	6-month Growth	Ranking		
				Absolute	Previous	Last 6 mths
Collaboration, Mass collaboration	7,840,000	1,987,000	5,853,000	1	1	1
Participatory web, Participation	2,535,000	1,500,504	1,035,000	2	2	2

Democracy	1,430,000	1,310,000	130,000	3	3	7
Knowledge management, knowledge sharing	1,078,000	466,000	1,031,000	4	5	3
Collective intelligence, wisdom of crowds	789,800	226,000	563,000	5	6	4
Long tail	761,000	502,00	259,000	6	4	5
Collaborative learning, eLearning	287,000	32,400	255,000	7	8	6

Table 1b: Online references to Web 2.0 tools

Tool	June 2008	December 2007	6-month Growth	Ranking		
				Absolute	Prev-ious	Last 6 mths
Blog	38,900,000	12,800,000	26,100,000	1	1	1
Social bookmarking, collaborative bookmarking, Tagging	20,500,000	1,501,000	18,999,000	2	6	2
Open source, Open content, Open systems	11,800,000	3,350,000	8,450,000	3	3	3
Wiki	11,700,000	8,590,000	3,110,000	4	2	8
RSS Feed	7,340,000	1,760,000	5,580,000	5	4	5
Podcast	6,860,000	1,730,000	5,130,000	6	5	6
Social networking	6,790,000	435,000	6,335,000	7	11	4

1.4.2: What are the major issues identified with its emergent use?

In the thirty days of online news examined, 2,877 articles referred to Web 2.0, but only 48 identified potential issues or controversial implications of its use, which can be summarized this in 8 categories of decreasing frequency (as indicated in brackets):

1. *Security and Cyber-criminality(14),* encompassing the increased security or fraudulent threat due to the use of Web 2.0 tools (e.g., phishing attacks)

2. *Externalities of transparency(10),* such the unexpected third party use of data through its placement on Web 2.0 tools (e.g., checking a job candidate's profile on Facebook)

3. *Moral and relativistic conflicts(6),* such as the conflict between censorship and free speech being played out in the Web 2.0 environment (e.g., Terrorism, Neo-Nazism, Pornography)

4. *Threats to vulnerable groups(5),* including increased issues with vulnerable groups or general consumer protection (e.g., sexual predators targeting children)

5. ***Effective use of resources(5)***, focusing on the need to extract value from Web 2.0 efficiently beyond social purposes (e.g., addressing social or business challenges, rather than only for social amusement or a source of time wasting or addiction)

6. ***Information overload(3)*** and quality, including the issues in generating huge amounts of difficult to filter information of poor quality (e.g., incorrect online health information)

7. ***Unequal or adverse influence(3)*** of mass opinion, such as low participation rates or control of Web 2.0 resources leading to either groupthink or the influence of the few over the "mob" (e.g., facebook's alleged aid to Obama campaign)

8. ***Web 2.0 user in the workplace(2)***, including individuals rights *to use* and *when using* Web 2.0 (such an employer's right to own any intellectual content added while at work)

1.4.3: What aspects of these issues are unique to Web 2.0?

While these issues are highly relevant to Web 2.0, they are not unique to it. For instance, Symantec's (2007) review of 2007 security trends highlighted a growing threat that across all aspects of the internet. Phishing, that was associated with Web 2.0 in a press article, was also a general trend, and obviously security threats are not unique to Web 2.0 unless of a threat type exclusive to Web 2.0. A second example is in moral and relativistic conflicts in the media, such as the Jyllands-Posten Muhammad cartoons controversy (Wikipedia, 2008b). While different issues, this demonstrates that international ideological conflicts arise just as easily in traditional media, and Web 2.0 is only a new forum for these discussions. However we were not able to discount all of these issues. Web 2.0's externalities of transparency and people's open participation appear specifically to change certain issue's nature. These are detailed in table 1c below with the differences marked in gray which we elaborate on further in question 5.

Table 1c: Issue areas specific to Web 2.0

Issue area	Example Web 2.0 issue	Issues in an analogous situation	Difference between issues
Security and Cyber-criminality	Sending malicious code via RSS (Trusted source, 2008) or phishing on MySpace (Savvas, 2008)	Phishing associated with the general internet and Web 2.0 not a top 10 security trend (Symantec, 2007).	None
Externalities of transparency	Use of facebook profiles to assess job candidates (Wiehl, 2008)		Externalities in Web 2.0 issues due to open participation (Business week, 2008)
Moral and relativistic	Threat of terrorism coordination through the use	Relativistic conflicts in the media, such as the	The agency of people related to an issue is

conflicts	of Web 2.0 tools (Wagner, 2008), such as the Al-Qaida advice column (Musharbash, 2008).	Jyllands-Posten Muhammad cartoons controversy (Wikipedia, 2008b).	changed due to their direct participation (e.g., Klamma et al., 2007)
Threats to vulnerable groups	Risks to youth are associated with contact by sexual predators (Tindal, 2008; Uitcaod, 2007)	Predators on vulnerable groups such as children, as noted in the history of the NSPCC (2008)	By web 2.0 participation, advertising children's location (Tindal, 2008; Uitcaod, 2007)
Effective use of resources	Facebook addicts who note that much of their time online is non-productive even for social objectives (Asay, 2008)	The concept of internet addiction and the waste of time and resource involved (Young, 1998).	None
Information overload	Difficulty in finding accurate online user generated health 2.0 information (The Economist, 2007)	Information overload through the internet, such as medical information (Eysenbach & Diepgen, 1998).	None
Unequal or adverse influence	Facebook not providing support to Hillary Clinton group in U.S election (Herbert, 2008)	Conflict of interest due to the control of media, for instance Berlusconi control of the Italian media (Hibberd, 2007).	The agency of people related to this issue is changed due to their direct participation (e.g., Klamma et al., 2007)
Web 2.0 user in the workplace	Ownerships by the firm of any material created online, such as using sites during the lunch hour (Bruce, 2008; Paton, 2007).	Legal rights of the employed inventor. (Orkin, 1974)	None

1.4.4: What are the major areas of Web 2.0 research?

The 41 papers making major contributions to the topic can be summarized in 7 major groups listed below in order of decreasing frequency (see annex 1 for summary):

1. *Internet information structure and application design with Web 2.0*, focusing on semantics or the structure of information generated, or building scalable applications

2. *Learning and education (eLearning 2.0)* for aiding learning and knowledge processes

3. *Health and Medicine (Medicine 2.0)* for health promotion

4. *Information system use, potential, and impact,* a "catch all" category that explores Web 2.0's potential and outcomes in a variety of contexts

5. *Organizational, social, and research implications of Web 2.0,* examining the broader implications of the tools on both organizations and social science research

6. ***Library management (Library 2.0)*** for electronic libraries

7. ***Marketing and advertising using Web 2.0,*** or approaches for firms to exploit Web 2.0

1.4.5: Which of these issues are addressed by Web 2.0 research?

Overall there is some agreement on the issues resulting from the emergence of Web 2.0 across press and research, and we highlight this in table 1d. However, some of the key issues identified in press are only noted, rather than explored, by the Web 2.0 literature, and research into internet ethics frames or discusses the issues differently. We will demonstrate this by exploring further the four issues identified as having specific Web 2.0 elements: *1) Externalities of transparency; 2) Unequal or adverse influence*; 3*) Moral and relativistic conflicts, and; 4) Threats to vulnerable groups.*

Table 1d. The exploration of Web 2.0 issues identified in press by Web 2.0 and internet ethics research

	Web 2.0 literature							Internet ethics
	Internet information structure and application design	**Learning and education**	**Health and Medicine**	**Information system use, potential, and impact**	**Organizational, social, and research implications**	**Library manage-ment**	**Marketing and advertising**	
Security/Cyber-criminality	Stearn (2007)	Dron (2007)	Downes (2007)					
Externality of transparency		Alexander (2008); Huang & Behara (2007);	McGee & Begg, (2008)		Parameswaran & Whinston (2008); Beer & Burrows (2007)			Partial
Moral/relativistic conflicts								Partial
Threats to vulnerable groups								Partial
Effective use of resources	Hendler & Golbeck, (2008); Rahwan et al., (2008); Battle & Benson (2008); Bojars et al., (2008); Tenenbaum, (2008)	Huang & Behara (2007);	Boulos & Wheeler (2007); Sandars & Haythornthwaite (2007);			Lankes et al. (2008); Liu (2008); Stephens (2007);	Cooke & Buckley (2008); Riegner (2007).	
Information overload	Hendler & Golbeck, (2008); Ankolekar et al. (2008);		McGee & Begg, (2008); (Boulos & Wheeler, 2007)					
Unequal or adverse influence		Dron (2007);	Sandars & Haythornthwaite (2007);			Lankes et al. (2008);		Partial
Web 2.0 user and the workplace					Zammuto, et al. (2007)			

Within *Externalities of transparency*, Alexander (2008) notes that pre-Web conceptions of social space, privacy and intellectual property are being challenged by Web 2.0, through the changing relations between the production and consumption of content such as the mainstreaming of private information posted to the public domain. This democratization of the production, distribution and consumption of knowledge was emphasized by Anderson (2006) as one of the main drivers of the Long Tail phenomenon. More substantially, the *Cathedral and the Bazaar* (Raymond 2001) offers an early model for grass-roots internet movements that challenge the socio-economic orthodoxy. While this seminal treatise was based on code development, it offered a reference for other communities seeking democratized production and distribution of social discourse. Hence, while this phenomenon was acknowledged before Web 2.0, the proliferation of Web 2.0 tools and mentalities has accelerated its sheer volume and social significance. Within the increased production of democratized and personalized content, there are still questions of privacy that people award to such information, even when posted in the public domain, (Beer & Burrows, 2007). These can have positive consequences, as in instances of political, media or human rights watch-dogs, or negative effects, in the case of unwanted surveillance or vigilantism (Chua et al. 2007). Inter-disciplinary research can address these issues, such as questions of who is watching (e.g., future employers) and if is this empowering anyone.

Authors note *unequal influence* or benefit in these interactions including: 1) disproportionally large influence from first contributors, known as the Matthew principle (Dron, 2007); 2) small from certain demographic groups, such as older users in medicine (Sandars & Haythornthwaite, 2007), or; 3) control issues from providers, such as that exercised on electronic library discussions (Lankes et al., 2008). While no precise solutions are proposed, Dron (2007) offers 10 principles for a Web 2.0 learning environment design that might reduce their effects, including developing awareness training addressing Web 2.0's strengths and pitfalls (Sandars & Haythornthwaite, 2007). However, literature has not fully explored the impact of the previously mentioned relationship with the Web 2.0 object, created due to a user's personal contribution to it.

Regarding *Threats to vulnerable groups* and *Moral and relativistic conflicts*, Web 2.0 literature has not significantly treated these subjects. Indeed, the overall focus has been on the effectiveness of Web 2.0 as an information dissemination or creation system (e.g., Boulos & Wheeler, 2007; McGee & Begg, 2008). Furthermore, the broader internet ethics literature, while noting these issues before, does not examine the Web 2.0 specific elements. For instance, Kracher & Corritore's (2004) discussion of Child pornographers alludes to predators finding children on the internet, but does not identify the issue of children advertising their details online. Sama & Shoaf (2002) discuss at length the use of private internet data but only in the

context of e-commerce transactions rather than "private" data voluntarily placed in the public domain. Van Alstyne and Brynjolfsson (2005) foreshadowed the issue of unequal influence in their paper on the Balkanization of the Internet, suggesting that the web allows fringe communities such as terrorists or illegal pornographers to cooperate to achieve critical mass for activities that would be impossible if individuals remained in isolation. However, we do not understand if this balkanization will be accentuated or moderated by Web 2.0's increased intimacy with internet objects or its improved efficiency or scaling.

1.5 Discussion

Table 1e summarizes these results, which we will attempt to thread together with the objective of attaining a better understanding of what Web 2.0 is and our responsibilities as researchers to study it.

Table 1e: Summary of results

Research question	Result
RQ1: What are the major salient themes found online that define Web 2.0?	*Web 2.0 as democratized collaborations via open and participatory web-based tools.* Web 2.0 connects participants in a democratic and open manner, harnessing the opportunities of collective wisdom or the long tail, to promote knowledge and learning. Many different tools enable this, including blogs, social bookmarking, wikis or social networking.
RQ2: What are the major issues identified with its emergent use?	48 press articles were found in 30 days of online media, that can be summarized in 8 categories of decreasing frequency: *Security and Cyber-criminality (14); Externalities of transparency (10); Moral and relativistic conflicts (6); Threats to vulnerable groups (5); Effective use of resources (5); Information overload (3); Unequal or adverse influence (3); Web 2.0 user in the workplace (2)*
RQ3: What aspects of these issues are unique to Web 2.0?	Most issues were not specific to Web 2.0. However, the following issues are change due to the user's relationship to the Web 2.0 artifact: E*xternalities of transparency, Moral and relativistic conflicts, Threats to vulnerable groups,* and *Unequal or adverse influence*
RQ4: What are the major areas of Web 2.0 research?	In peer-reviewed literature, we found 41 papers that made significant or empirical contribution to Web 2.0 research. They can be summarized in 7 major groups (see annex 1 for details): Internet information structure and application design with web 2.0; Learning and education (eLearning 2.0); Information system use, potential, and impact (of Web 2.0); Health and Medicine (Medicine 2.0); Organizational, social, and research implications of Web 2.0; Library management (Library 2.0); Marketing and advertising using Web 2.0;
RQ5: Which of these issues are addressed by Web 2.0 research?	Of the issues specific to Web 2.0 elements, *Externalities of transparency* and *Unequal or adverse influence* are partially explored by Web 2.0 literature, *Moral and relativistic conflicts* and *Threats to vulnerable groups* are not. Broader internet ethics literature addresses these topics, but neglects important elements of their manifestation specific to Web 2.0

1.5.1 A definition that avoids the tool confusion

There is a major difference in this proposal compared to previous definitions, considering the emphasis on democratized and participatory online activities rather than tools, combined with a relationship with or change in agency from an internet artifact. Firstly, some authors have described Web 2.0 as *an attitude not a technology* (Lin, 2007), and the weakness of the tools based view was shown in research question 1. The nature of this online conversation changing, with the importance of Wikis, RSS feeds, podcasts all declining, and the importance of social bookmarking and social networking are rising. Sites and technologies in O'Reilly's (2005) definition, like the peer-peer file sharing site Napster, now receive less attention than newer social networking sites like Facebook or MySpace. Furthermore, this definition required an exclusion list to clarify Web 2.0 use, such as email which is clearly participatory. This confusing definition has led ubiquitous tools such as Google to being described as the quintessential Web 2.0 company (Giustini, 2006), who's extensive use suggests that Web 2.0 and the internet are synonymous. Hence, this concurs with other authors that the associated tools can be noted simply as an initial sensitizing concept (Beer & Burrows, 2007), but do not describe the phenomena precisely.

Secondly, avoiding this tools-based view is also supported by research question 3, given that there may be limited change in agency when using certain tools normally associated with Web 2.0. Of series of issues related to Web 2.0, many have not been fundamentally re-defined by it, and although increasing their scope a new conceptual portfolio is probably not required to address them. The only case specific to Web 2.0 is a change of agency due to a relationship with an online artifact. Other authors have noted this, describing it as an instrumental relationship the Web 2.0 object (Aguiton & Cardon, 2007) or observing a change in agency (Klamma et al., 2007). This potentially explains the observation that importance of Wikis, RSS feeds and podcasts are declining, whereas the importance of social networking is dramatically rising. This new emphasis could be related to focusing on tools that are purely participative (a defining characteristic of Web 2.0). Since there is little investment on the part of the individual in using Google (or email), relative to contributing to knowledge or revealing personal information online, these are not core to Web 2.0.

Hence combining these insights more clearly delineates the field of Web 2.0 research, providing clearer focus and scope. In making this combination we must consider that all IT artifacts can be tools for information processing or social relations (Orlikowski & Iacono, 2001). Hence, we re-state the Web 2.0 definition as *an adaptive information or technical system, and a social system, in which individuals have a relationship with Web 2.0 artifacts different to either traditional media or the internet*. Otherwise stated, the visibility of 'things' or the participative manner in which they are created and framed changes individual's agency (Klamma et al., 2007). Established issues relating to internet use are significantly changed by the user's relationship

with the internet object, manifested in areas such as *Externality of transparency, Moral and relativistic conflicts, Threats to vulnerable groups,* and *Unequal or adverse influence (of mass opinion).*

To demonstrate its adaptive nature, we can interpret the history of one of the early Web 2.0 tools, Napster (O'Reilly, 2005). It blurred the boundary between consumer and producer (Spitz & Hunter, 2005), and viewing it as a tools-based phenomena, record companies sought to shut it down via technical and legal means. Despite succeeding with Napster, peer-peer networks continue to effect music sales through many technologies (Bhattacharjee, et al. 2007). Authors have noted that Napster was more than a peer-peer file sharing tool, but spurned a social phenomena empowering music users, that was impossible to stop due to the low switching costs between technologies (Arora, Hanneghan & Merabti 2005; Giesler & Pohlmann, 2003). Clearly, the Napster case was more complex than this, but this example serves to demonstrate author's claims on the complex adaptive nature of Web 2.0 (Cooke & Buckley, 2008). It adapts with new users and contributions (either in content or via enhancing applications) that can switch between tools, formats or standards to defend its interests.

1.5.2 A Roadmap for Web 2.0 research

Many of Web 2.0's associated ideas such as online user forums and wikis, when used in certain forms such as a passive reader of online content, are simply evolutions of internet trends long before the term was popularized. Hence, core Web 2.0 research is less concerned with information processing elements of specific tools, such as how user generated content is produced. This is despite the fact that its *efficiency as an adaptive information system* has already been explored by authors, largely in examining semantic web and collaborative technology approaches (Hendler & Golbeck, 2008; Tenenbaum, 2008; Battle & Benson, 2008; Bojars et al., 2008), or the apparent wisdom of crowds becoming the stupidity of mobs (Dron, 2007; McGee & Begg, 2008). However, these results suggest that Web 2.0 research is the exploration distinct changes through people's relationships with internet objects due to open participation and information sharing.

Researchers must also be conscious of overlapping but distinct research areas such in social computing and online communities. While some authors treat social computing as a similar concept (Parameswaran & Whinston 2008), it refers to software that serves as an intermediary or focus for social relations (Schuler, 1994), extends far beyond open web-based participation. Furthermore, Web 2.0 does not presume the existence of an online community as cooperation in Web 2.0 can be limited. Users often do not necessarily interact with each other, but rather develop instrumental intimacy via the Web 2.0 object (Aguiton & Cardon, 2007). Once again this area sits distinct from, even though important to, Web 2.0 research. Hence, we offer the

Web 2.0 definition and framework in figure 1b to clarify Web 2.0 research position in relation to other fields, with Web 2.0's core focus indicated in grey.

Figure 1b: Framework for locating Web 2.0 research

Area	**Adaptive participatory technical and social system,** in which individuals or organizations have a relationship with Web 2.0 objects	**Adaptive information system** for generation and dissemination of content	**Adaptive social system** for collaboration and cooperation
Typical research	**Techno-socio systems,** with focus on the implications of individuals' or organizations' relationship with Web 2.0 objects	**Study of individual tools or tool systems,** such as semantics or user generated content development in wikis	**Study of online communities,** with focus on user to user relations or cooperative dynamics
Issues	**New issues are introduced due to the relationship of individuals with Web 2.0 objects,** and include issues of Externality of transparency, Moral and relativistic conflicts, Threats to vulnerable groups, Unequal or adverse influence	**Extension of the current internet issues** of Security and Cyber-criminality, Effective use of resources, Information overload, and IS use and the workplace	**Extension of issues in online communities research,** such as trust

☐ **Core Web 2.0 research**

Accordingly, we identify three underlying tensions and focus areas that could guide relevant Web 2.0 research, including: 1) the characteristics of the adaptive technical-social system or network; 3) the impact of Web 2.0 as an instrumental object or social agent, and 3) the issues related to Web 2.0 and their implications for Web 2.0 governance.

Firstly, research needs to tackle the broader and difficult task of how different production and dissemination tools, and the consumers and producers of content, interplay to impact these collaborations. In particular we need to take into account the Darwanistic nature of this environment (Boulous & Wheeler, 2007) where the underlying tool set and social system are under rapid change, and understand the characteristics of such an evolving system where users have relationships with web objects. We have seen a rise in research into social system or network characteristics over the last three decades, examining the structural relations of social networks (Granovetter, 1985; Gulati, et al., 2000). The common structural determinants of networks include network density (Meagher and Rogers, 2004), centrality (Freeman 1979, Scott, 2000), as well as nodes, ties, cutpoints and bridges (Wasserman and Faust, 1994) amongst other characteristics. The notion of weak cooperation via Web 2.0 (Aguiton & Cardon, 2007) suggest these dynamics could change considerably through increased scale and scope of networking, such as addressing online community size limits (see Butler, 2001).

Secondly, Web 2.0 as an instrumental object or social agent suggests that Web 2.0 changes people's relationship with internet objects and their intimacy with other social agents. Researchers should examine to what degree the interaction is with the technology objects themselves, and what degree it is with the community of users. We know that Web 2.0 technologies are the enabling interlocutors, but we can also assume a continuum metaphor ala Daft and Lengel (1986), that highlights how technological media can constrain communication richness at various levels. It follows that in addition to constraining or enabling communication scope or richness in social context, Web 2.0 technology objects could feasibly replace it – offering interaction/intimacy with a technology object first and foremost, substituting the social interaction. Once again, a continuum metaphor is likely the most appropriate here; research could study the levels of technical and social intimacy enabled by Web 2.0 technologies, as users transverse from technology interaction to true social interaction, and understand the effects on the outcomes of the collaboration of these extremes.

Finally, Governance of Web 2.0 addresses the vast discipline of group or organizational behavior. Without citing a plethora of literature, the mechanisms of group and organizational governance range from formal to informal, emergent to designed, democratic to dictated. In most schools of organizational and political behavior, the control of information and communication are synonymous with influence and power. Changes in the character and ownership of communication channels have been long recognized as determinative to organizational governance, and Web 2.0 tools are viewed as a further step in the communications revolution that extend the constant evolution of the printing press and radio transmission. The democratized, highly evolving nature of Web 2.0 tools suggests that it will

also be determinative - if not disruptive - to the art/science of organizational leadership and political control of socio-economic institutions. It will be of interest to understand if a Marxian usurping of the controlling economic orthodoxies foreshadowed by the Cathedral and Bazaar (Raymond 2001) and echoed in The Long Tail (Anderson 2006) will be a reality, or what the determinants of differential influence might be in an otherwise democratized -Web 2.0 - social and political arena. In particular we may initially concern ourselves with, but restrict research to, the aforementioned issues of Externalities of transparency, Moral and relativistic conflicts, Threats to vulnerable groups, and Unequal or adverse influence. In its widest scope, successfully addressing this governance may involve a mix government regulation, organizational responsibilities, group or community governance and the responsibilities of the individual.

Overall, researchers looking at the topography of the digital environment, and the social, economic, technological, political and cultural factors that are shaping that environment cannot ignore the subtle changes provoked by Web 2.0, but also need to avoid citing it when any kind of modern participatory tools is under consideration. Moreover, given the socio-technical nature of Web 2.0, we concur with other authors to suggest its study will require large inter-disciplinary research efforts (Klamma et al., 2007), to "generate new theories and concepts … related to collaborative and creative concentration as a result of … new forms of digital networks" (Wiberg, 2007).

1.5.3 Limitations

Two main limitations arise out of this study, bias from the use of search engines to collect data, and the limited number of case examples examined in research question 3. Regarding the first limitation, we went to great pains to review criticisms of Google Page Rank and mitigate sources of bias. This included extrapolating findings from highly ranked pages to the entire public internet, following author's recommendations to use longitudinal data, and using only most salient themes (i.e., those with a count of over 10,000).

The second limitation is imposed on us, that in research question 3 we only used one case example from each issue area. This constraint arises from the infeasibility of systematically reviewing all possible analogous cases to identify elements specific to Web 2.0. For instance, there is a huge mass of literature on Child predators alone. Firstly, we mitigated this by looking for patterns rather than attempting to determine if any one specific issue is Web 2.0 related or not, and cannot make conclusions of the uniqueness of any one specific issue. Secondly, we performed a review of Web 2.0 literature to situate this analysis in the context of scholar's observations.

1.6 Concluding remarks

This paper posed 3 initial questions, to identify the major salient themes found online that define Web 2.0, the major issues identified with its emergence, and what aspects of these issues are specific to

Web 2.0. We suggest a definition of Web 2.0 as *democratized collaborations via open and participatory web-based tools, where users have instrumental relationships with web artifacts that changes their agency.* This definition clearly delineates Web 2.0 from other areas of research, and also addresses the dilemma of understand what constitutes a Web 2.0 tool that bedeviled previous Web 2.0 definitions. Web 2.0 research is separate to those that study online information systems without examination of this relationship, even if examining typical tools associated with the term. Conversely, Web 2.0 is separate to research into online communities that presume cooperation, not required for Web 2.0 systems, and may not focus on the user's relationship with the internet object. In this context there are three areas that are potential priorities for Web 2.0 research, Web 2.0 research, including: 1) the characteristics of the adaptive technical-social system or network; 3) the impact of Web 2.0 as an instrumental object or social agent, and 3) the issues related to Web 2.0 and their implications for Web 2.0 governance, including externalities of transparency, moral and relativistic conflicts, threats to vulnerable groups, unequal or adverse influence. Much inter-disciplinary research will still be required to fully understand the concept. As a term gaining critical mass in literature, it is important for research to use coherent definitions, and to delineate its specific research areas. In response to this, we offer the above definition to promote future research. To our knowledge, this is the first empirically based Web 2.0 definition in literature, and in offering this view of Web 2.0 based on issues, we believe this paper proposes a relevant approach to close the gap between research and practice.

2. Medicine 2.0: Tensions

Abstract

Background: The term *Web 2.0* became popular following the O'Reilly Media Web 2.0 conference in 2004; however, there are difficulties in its application to health and medicine. Principally, the definition published by O'Reilly is criticized for being too amorphous, where other authors claim that Web 2.0 does not really exist. Despite this skepticism, the online community using Web 2.0 tools for health continues to grow, and the term *Medicine 2.0* has entered popular nomenclature.

Objective: This paper aims to establish a clear definition for Medicine 2.0 and delineate literature that is specific to the field. In addition, we propose a framework for categorizing the existing Medicine 2.0 literature and identify key research themes, underdeveloped research areas, as well as the underlying tensions or controversies in Medicine 2.0's diverse interest groups.

Methods: In the first phase, we employ a thematic analysis of online definitions, that is, the most important linked papers, websites, or blogs in the Medicine 2.0 community itself. In a second phase, this definition is then applied across a series of academic papers to review Medicine 2.0's core literature base, delineating it from a wider concept of eHealth.

Results: The terms *Medicine 2.0* and *Health 2.0* were found to be very similar and subsume five major salient themes: (1) the participants involved (doctors, patients, etc); (2) its impact on both traditional and collaborative practices in medicine; (3) its ability to provide personalized health care; (4) its ability to promote ongoing medical education; and (5) its associated method- and tool-related issues, such as potential inaccuracy in user-generated content. In comparing definitions of Medicine 2.0 to eHealth, key distinctions are made by the collaborative nature of Medicine 2.0 and its emphasis on personalized health care. However, other elements such as health or medical education remain common for both categories. In addition, this emphasis on personalized health care is not a salient theme within the academic literature. Of 2405 papers originally identified as potentially relevant, we found 56 articles that were exclusively focused on Medicine 2.0 as opposed to wider eHealth discussions. Four major tensions or debates between stakeholders were found in this literature, including (1) the lack of clear Medicine 2.0 definitions, (2) tension due to the loss of control over information as perceived by doctors, (3) the safety issues of inaccurate information, and (4) ownership and privacy issues with the growing body of information created by Medicine 2.0.

Conclusion: This paper is distinguished from previous reviews in that earlier studies mainly introduced specific Medicine 2.0 tools. In addressing the field's definition via empirical online data, it

establishes a literature base and delineates key topics for future research into Medicine 2.0, distinct to that of eHealth.

Keywords

Web 2.0; Medicine 2.0; Health 2.0

3. Doctor's use of Web 2.0

Abstract

Background: Web 2.0 internet tools and methods have attracted considerable attention as a means to improve health care delivery. Despite evidence demonstrating their use by medical professionals, there is no detailed research describing how Web 2.0 influences physicians' daily clinical practice. Hence this study examines Web 2.0 use by 35 junior physicians in clinical settings to further understand their impact on medical practice.

Method: Diaries and interviews encompassing 177 days of internet use or 444 search incidents, analyzed via thematic analysis.

Results: Results indicate that 53% of internet visits employed user-generated or Web 2.0 content, with Google andWikipedia used by 80% and 70% of physicians, respectively. Despite awareness of information credibility risks with Web 2.0 content, it has a role in information seeking for both clinical decisions and medical education. This is enabled by the ability to cross check information and the diverse needs for background and non-verified information.

*Conclusion:*Web 2.0 use represents a profound departure from previous learning and decision processes which were normally controlled by senior medical staff or medical schools. There is widespread concern with the risk of poor quality information with Web 2.0 use, and the manner in which physicians are using it suggest effective use derives from the mitigating actions by the individual physician. Three alternative policy options are identified to manage this risk and improve efficiency in Web 2.0's use.

Keywords

4. Doctors' online information search

Hughes, B., Wareham, J, Joshi, I. Doctors' online information needs, cognitive search strategies and judgments of information quality and cognitive authority: How predictive judgments introduce bias into cognitive search models. *Journal of the American Society of Information Science and Technology (forthcoming)*.

Available: http://www3.interscience.wiley.com/journal/123190006/abstract

Abstract

The literature that examines information judgments and internet search behavior notes a number of major research gaps, including how users actually make these judgments outside of experimental settings or researcher-defined tasks, and how search behavior is impacted by a user's judgment of online information. Using the medical setting, where doctors face real consequences in applying the information found, we examine how information judgments employed by doctors to mitigate risk impact their cognitive search models. Diaries encompassing 444 real clinical information search incidents, combined with semi-structured interviews across 35 doctors, were analyzed via thematic analysis.

Results show that doctors, though aware of the need for information quality and cognitive authority, rarely make evaluative judgments during search. This is explained by navigational bias in information searches and via predictive judgments that favor known sites where doctors perceive known levels of information quality and cognitive authority. These predictive judgments are enabled by doctors' mental models of the internet sites, and web experience relevant to the task type. These results suggest an emerging model connecting online cognitive search and information judgment literatures. Moreover, a number of major implications for research are detailed. These include understanding cognitive search through longitudinal or learning based views for repeated search tasks, and adaptations to medical practitioner training and tools for online search

Key words

Medical information seeking, cognitive internet search, information quality, credibility, cognitive authority

5. Democratized Collaboration in Pharma

Hughes, B., Wareham, J. 2008. Democratized Collaboration in Big Pharma. *Academy of Management Conference, August 8-13, Anaheim, CA.*

Abstract

Despite the proliferation of Web 2.0 tools in the technology and media sectors, their potential in the Pharmaceutical industry is poorly understood. This study based on 120 interviews with top management of a global pharmaceutical company assesses the potential of Web 2.0 and other online collaboration tools across the value chain. It examines the structural design criteria required to launch initiatives and conditions for their inclusion in business processes. Two main areas of high potential are identified, as well as the collaborators involved, and nine structural design criteria for managers. Furthermore, we propose generalized structural design criteria for validation by future research.

5.1 Introduction

The term Web 2.0 became popular following the O'Reilly Media Web 2.0 conference in 2004, and represents a second generation of web-based tools and communities (social-networking sites, wikis), which aim to facilitate collaboration between users. The difficulty in defining the term is well documented: "*Web 2.0 is one of those terms that resists definition, either because the concept is too amorphous to have any real meaning, or because the underlying phenomenon is so huge and important that it defies any attempt to pin it down*" (McFredries, 2006 : 68). Using the online community of bloggers participating in the phenomena itself, and Google's page rank system that allows the most favored online definitions to be examined, research has shown that social bookmarking, open source or platforms and *blogs* are the tools most commonly associated with Web 2.0 (Hughes & Wareham, 2009). However the tools associated with Web 2.0 vary frequently, and definition of Web 2.0 is better understood democratized collaborations via open and participatory web-based tools, which act as an adaptive technical and social system in which individuals have a relationship with Web 2.0 artifacts.

Democratized collaborations are relevant to the pharmaceutical industry as Big-Pharma business models are facing challenges due to declining R&D productivity and shorter exclusivity periods, which have reduced returns on new investment to an unsustainable 5% (Gilbert, Henske, & Singh, 2003). The Pharma response to this is to embrace open innovation and collaboration, as clearly stated in the annual reports of many Big-Pharma companies in 2006. Moreover, while successful case examples in Pharma are few, the potential of

democratized collaborations in healthcare is well documented: "*The possible uses of online communities in the field of community health are almost endless*" (Crespo, 2007 : 75).

In examining literature on democratized collaborations focused on the technology and media sectors, such as *Wikinomics* (Tapscott & Williams, 2006)*, Open business models* (Chesbrough, 2006)*,* and *Democratizing Innovation* (von Hippel, 2005)*,* we searched for a generalized criteria for designing these collaborations. While the literature suggests that structural design criteria are important for community building (Raymond, 1999:47-49), it offers few normative design principles for distributed innovation systems. Exceptions include Fischer and Giaccardi (2007) or Baldwin & Clark (2005), who specify focal antecedents of open source projects, such as the modularity of tasks.

In order address the need for specific, validated design criteria for democratized collaboration, we conducted a study based upon interviews with 120 managers at a major pharmaceutical company, typically classified as Big-Pharma. Data was collected during an internal study with the objective of developing an innovative Information Technology strategy that explicitly embraced value creation from democratized collaborations. The main research questions addressed are as follows:

1. Are democratized collaborations applicable to the pharmaceutical value chain, to more than one part, and with both internal and external participants?

2. Are there common structural[1] design criteria to consider for a company to launch a democratized collaboration initiative in Pharma?

3. Can democratized collaborations be included in normal business processes, as opposed to being treated as isolated projects and monitored by top management?

In the course of our study, 10 democratized collaborations were chosen by our case company as viable areas for democratized collaboration in the pharmaceutical value chain. From these results, our study highlights four important findings not yet captured in management literature. Firstly, that the areas of the Research & Development and Marketing in the Pharma value chain[2] are areas of high potential for democratized collaborations. Secondly, we identify nine common structural design criteria to launch these collaborations based on required inputs, processes and

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[1] By structural design criteria, we mean those that managers would need to consider from the outset of the initiative. This is opposed to implementation considerations, such as participant's incentives, that can be adapted as the community is established

[2] The term value chain in this study is used to describe the different process and functions of the company's business only, no other value chain analysis was completed. The term was defined by Porter (1985). The specific version used is detailed in annex 5.

structure. Thirdly we identify and discuss difficulties in including these types of collaborations in business as usual strategy.

The paper follows by surveying the relevant literature on democratized collaboration, big pharma business models, and the application of democratized collaboration in big pharma. We then proceed to discuss the specifics of the study; the data collection, analysis, and results. We review the findings with a discussion highlighting the main results of our study as compared to findings extant in the literature. The paper concludes by considering implications for theory and management.

5.2 Research Framework

5.2.1 Big-Pharma Business Models

This case study deals with a Pharmaceutical company that can be considered Big-Pharma. While no agreed definition of Big-Pharma exists, McKinsey & Company published a list of companies considered Big-Pharma in 2001 (Agarwal, Desai, Holcomb, & Arjun, 2001) . This categorization divided the major players into three groups: Super heavyweights with revenue of more than $20 billion including Pfizer and GlaxoSmithKline; Heavyweights with revenue of $10 billion to $20 billion including Merck, AstraZeneca, Bristol-Myers Squibb, Novartis, Aventis and Johnson & Johnson; Middleweights with revenue of $7 billion to $10 billion including American Home Products, Pharmacia, Roche, Eli Lilly, Abbott Laboratories, Schering-Plough and Bayer.

In the last two decades the largest players initiated a spate of mergers that created more members of this class of heavyweight, with annual drug revenues of more than $20 billion. Executives cited the benefits of size as part of the rationale for making these deals: size provides an edge in launching blockbuster drugs, which can individually generate $1 billion or more in annual revenues; it increases the number of bets a company can place on new technologies; it helps complete clinical trials more quickly, and it increases its desirability as a licensing partner (Agarwal, Desai, Holcomb, & Arjun, 2001).

In this research context, there are three important consequences of the Big-Pharma business model. Firstly, a full set of activities can be assessed for collaboration potential:"*Big-Pharma or fully integrated pharmaceutical companies (FIPCOs) are capable of covering the entire value chain, from discovery to marketing ... for the international or global market*" (Granberg & Stankiewicz, 2002 : 5).

Secondly the Big-Pharma value chain is a set of non-identical value chains across different business lines. Looking at financial reports of the Big-Pharma companies we can see

recognition of this (see table 5a). Pharmaceutical results are typically broken into key products and treatment types (e.g., Cardiovascular, Gastrointestinal, Neuroscience, Oncology, etc.), but also into business lines. Based on the 2006 financial reports of five majors companies, we can classify these business lines as Pharmaceutical, Vaccines, Generics, Consumer Health, Animal Health and Medical Technology. Not all of these divisions exist in our case company, but where applicable, this separation of divisions was used to understand the potential impact of Web 2.0 in each business line.

Table 5a: Business line as reported in financial reports 2006 (USD billions)

Division	J&J	Pfizer	Novartis	Astrazeneca	GSK
Pharmaceutical	23,267	45,083	22,576	26,475	15,239
Vaccines			956		1,692
Generics			5,959		
Consumer Healthcare	9,774		6,540		3,147
Animal Health		2,311			
Medical Technology	20,283			n/a[3]	
Total	53,324	47,394	36,031	26,475	23,225

Thirdly, the Big-Pharma business model is under rapid change. Gilbert, Henske, & Singh (2003) sum up the challenges, citing declining R&D productivity, rising commercialization cost and payor influence, and shorter exclusivity periods reducing returns on new investment to an unsustainable 5%. They propose that mergers conceived to build scale will not improve returns, and that pharmaceutical companies need new business models to restore healthy financial results. Specifically they propose four potential solutions, including focusing on R&D efforts and commercial capabilities, making use of product and capability partnerships, providing customer solutions, and creating a business unit based organization model. In addition they claim that breaking out of the blockbuster mentality (the quest for larger and larger opportunities in whatever disease areas they may occur) will require planned experimentation, aggressive use of partnerships, and far-reaching transformations in how companies organize to compete.

Indeed, this pressure is a reason that collaborating with partners to extract potential from the value chain seems to be Big-Pharma's aim in 2007. Evidence from financial reports include:

- "Engaging – collaboratively with patients, customers and business partners" (Pfizer, 2006 : 34)

- "We are looking for innovation wherever we can find it, inside or outside the company – something we call Open Innovation. We have also increased alignment between R&D and our

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[3] Astra tech reported separately in annual reports; SEK 2.7 billion

global brand teams so we understand consumers' needs better and can deliver more innovative products that meet those needs." (GSK, 2006: 7)

- "Accessing attractive external opportunities to enhance our internal innovation through partnerships, alliances and acquisitions that further strengthen our pipeline of new products" (Astrazeneca , 2006 : 11)

We can infer from companies' intentions going into 2007 that a potential exists, and that pharmaceutical executives intend to exploit this opportunity. The challenge in a large global company is to identify within different business lines or divisions where the most strategic advantage and value can be delivered**.**

5.2.2 Democratized collaborations in healthcare and Big-Pharma

Physicians, with whom pharmaceutical companies spend over $11 Billion annually in marketing (Wazana, 2000), have clearly demonstrated their interest in Web 2.0: "*Google—the quintessential Web 2.0 company, —is a useful diagnostic aid. Doctors can retrieve lots of evidence and open access material via search tools, and they need to learn how to use these tools responsibly*" (Giustini, 2006; Boulos MNK, 2006). Moreover, a number of publications show the potential of open source in biotechnology, including *A case for open source bioinformatics* (Birney, 2002) *Open Source Genomics* (Burk, 2002), *Open Source Biotechnology* (Hope, 2005). The best known is the Human Genome Project, but there are both similar and other case examples that can be considered democratized collaborations relevant to the pharma industry. They can be summarized in three types: 1) open collaborations on pharmaceutical science and products supported by innovative tools; 2) open source efforts to improve development tools for the academics and companies in the industry; 3) wider collaborative efforts to understand patients' issues in disease treatments. Examples include:

1. The Myelin repair foundation which "brings together a world-class team of research scientists and provides them with a collaboration infrastructure in which discoveries are shared immediately without the delays associated with the publication of scientific papers" (Myelin Repair Foundation, 2007), or The Open Prosthetics Project, where prosthetics CAD designs are downloaded, altered and uploaded to the community; designs are free to be used by anyone (Open Prosthetics Project, 2007)

2. Software development projects such as BioPerl, an international open-source collaboration of biologists, bioinformaticians, and computer scientists working to develop a comprehensive library of Perl modules for managing and manipulating life-science information (Stajich & al., 2002)

3. Online patient communities, including Organizedwisdom or Braintalk, for which there are some extensive press reviews such as Health 2.0 (Economist, 2007)**.** The potential of online

patient communities has been recognized by the healthcare industry in general, "The possible uses of online communities in the field of community health are almost endless" (Crespo, 2007 : 75)

Moreover, Open Innovation is not entirely new to the pharmaceutical sector. Gassmann & Reepmeyer (2005) argue that many pharmaceutical companies already work with multiple outsourcing partners during the innovation process to build greater experience in managing value networks rather than just value chains. In 1999, pharmaceutical companies spent 25 percent of their R&D budgets for services provided by outside research organizations. One example is the drug Lipitor now owned by Pfizer, in the lucrative cholesterol-lowering drug market, which was originally licensed from Yamanouchi. Pfizer used its unique marketing strength and sales capabilities to turn this externally sourced 'me-too' drug into the most successful blockbuster ever. However, relative to the potential of Web 2.0 to enable democratized collaborations as shown in technology and media sectors, this form of open innovation is relatively closed and does not bring together participants to exploit network effects in a manner enabled by IT. Rather, it is a make-or-buy decision with "*Preferred partnerships and co-operation on a project-by-project basis with pre-selected vendors are the two most favorable co-operation models in practice*" (Gassmann & Reepmeyer, 2005 : 224).

Despite the above exceptions, in our literature review we were unable to highlight significant contributions concerning democratized collaboration, particularly in their impact on pharmaceutical companies or in the structural design criteria required to launch these collaborations.

5.2.3 Literature identifying democratized collaborations' structural design criteria

Two literature groups potentially provide indications of democratized innovation structural design criteria relevant to Pharma, Wikinomics, including open source, and open innovation. Tapscott and Williams (2006) identify seven Web 2.0 business-models and also offer structural design principles such as following lead users, building critical mass and ensuring all participants harness value. They build on research into open source projects with a body of empirical evidence based on communities such as soruceforge.net (Lakhani & Panetta, 2007). This has shown that structural design criteria such as modularity of tasks and option value are important (Baldwin & Clark, 2005). However, researchers examining the potential of open source in biotechnology, while not proposing structural design criteria themselves, have noted that not all strategies can be simply transferred (Hope, 2005 : 6).

In contrast, the principles of open innovation apply directly, and Chesbrough (2006) notes that drivers such as the rising cost of development and shorter product lifecycles are present in the Pharmaceutical industry. He states that understanding a company's IP position in an area where they wish to undertake open innovation is as a key criteria for successful design.

Hence, while our literature review identifies IP position as a relevant criteria to democratized collaborations in Pharma, applicability of criteria such as lead user capture, critical mass and modularity of tasks cannot be assumed, and must be validated through further research.

5.3 Research design

5.3.1 Sample

All 120 structured interviews were completed with middle to senior managers at a global pharmaceutical company, with 9 validation workshops with the majority (90%) of interviewees. The company itself dictated a minimum sample size and selected the appropriate interviewees to capture a broad spectrum of opinion. In total, 28 of the interviewees where completed with the CEO or general manager, CFO and CIO of the division in question. The sample was selected to cover all parts of the company's value chain, ensuring all departments or functions were consulted (detailed in annex 5).

5.3.2 Data collection

In order to understand the potential of collaborative initiatives using Web 2.0 tools against other business priorities, three kinds of information needed to be measured: business priorities of the division; priorities for IT in general, and priorities for new IT tools based on Web 2.0. The data collection was completed in two parts, an initial set of interviews with 120 of the company's top managers, and a selection process via workshops, where the interviewees were assembled to select the ideas identified by individual interviews.

Interviews were completed via teleconferences of 1 hour each. Four types of questions were asked as detailed by the structured interview guide in annex 5: divisional strategy, divisional IT strategy, democratized collaboration potential, and IT delivery model. Embedding the identification of democratized collaboration potential in the overall IT strategy avoided any bias by setting it in the context of overall operational priorities. This case library of different types of Web 2.0 use was already familiar to many of the managers. Note that the interview should be considered semi-structured, as very senior managers were able to easily express the overall vision without needing structured questions. Each interview was recorded and transcribed based on interview notes, and then validated by the interviewee. These were published to a shared online workspace prior to the workshops; where 24% of interviewees provided corrections on their interview transcripts at this stage.

The results of each interview were aggregated and presented back to participants in the workshop. The group selected potential initiatives, though it was possible to select none.

5.3.3 Analysis methods

To analyze the results, only final documents validated by the company's top managers were used. In addition to interview transcripts, final recommendations including 5-20 page documents describing each of the approved initiatives were examined. While we assisted in the logistics of preparing these recommendations, the selection process and final reports were completed entirely by the company with our roles limited to observation. Coding and thematic analysis was used on these final reports to determine results, such as the different parties identified for potential collaborations, or the structural design criteria for launching them.

5.4 Results

5.4.1 Research question 1: Democratized collaboration applicability to Pharma

The board of the pharmaceutical company approved 21 initiatives, each with a top manager as owner with a firm commitment for execution. However, not all of these initiatives can be considered as democratized collaborations or initiated by the study. Only 10 of 21 initiatives were Web 2.0 related, even though all were considered cutting edge in terms of use of innovative IT. None of these initiatives were to join or profit from existing democratized collaborations, but rather to create new ones specific to the pharmaceutical company's needs. Table 5b shows the breakdown of approved initiatives by type.

Table 5b: Breakdown of launched initiatives

Initiative type	Total	Of which existing[4]	Of which with business case	Of which corporate
Web 2.0	10	2	1	3
Other	11	5	5	2

In relation to research question 1, are democratized collaborations applicable to the pharmaceutical value chain, this company's assessment shows they are relevant to multiple parts with both external and internal participants. Specifically, there are clear opportunities in all sub-sections of the R&D part of the value chain, as well as in Sales & Marketing including Product Development and Life Cycle Management, Pricing and Health Economics, and Market a Product processes. Table 5c summarizes selected initiatives across the different divisions.

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[4] Extension of existing initiation under pilot

Table 5c: Description of launched web 2.0 initiatives

Initiative number	Internal value chain	Nature	External participants[5]
1	R&D Market a product	Online communities *(for consumer research)*	Consumers and health care professionals
2	All value chain components (R&D, operations etc.)	Wiki and search tools *(for information integration)*	n/a
3	R&D	Open innovation platform *(e.g., Innocentive)*	Academic/Clinical collaborators
4	R&D	Web 2.0 style Meta data standards *(for information integration)*	Academic/Clinical collaborators
5	R&D	Wiki and search tools *(for treatment research)*	Academic/Clinical collaborators
6	R&D and Product development/lifecycle management	Wiki and search tools and clinical data sharing *(for information integration)*	n/a
7	R&D	Wiki and search tools *(for information integration)*	n/a
8	R&D	Online communities *(for treatment research)*	Academic/Clinical collaborators and Health care professionals
9	Pricing and health economics	Wiki and search tools and clinical data sharing *(for new service innovation)*	Payors
10	R&D	Online communities *(for treatment research and drug approval)*	Academic/Clinical collaborators, Health care professionals and regulators

Managers selected priority collaborations reflecting the importance of these participants to that particular division, identifying 13 participants, of which 5 were external. However, 10 other participants were assessed as potential collaborators in the interview process, and identified via coding of interview transcripts (see annex 5 for full coding results). These are shown in figure 1.

Figure 1: Potential participants for democratized collaborations in Pharma
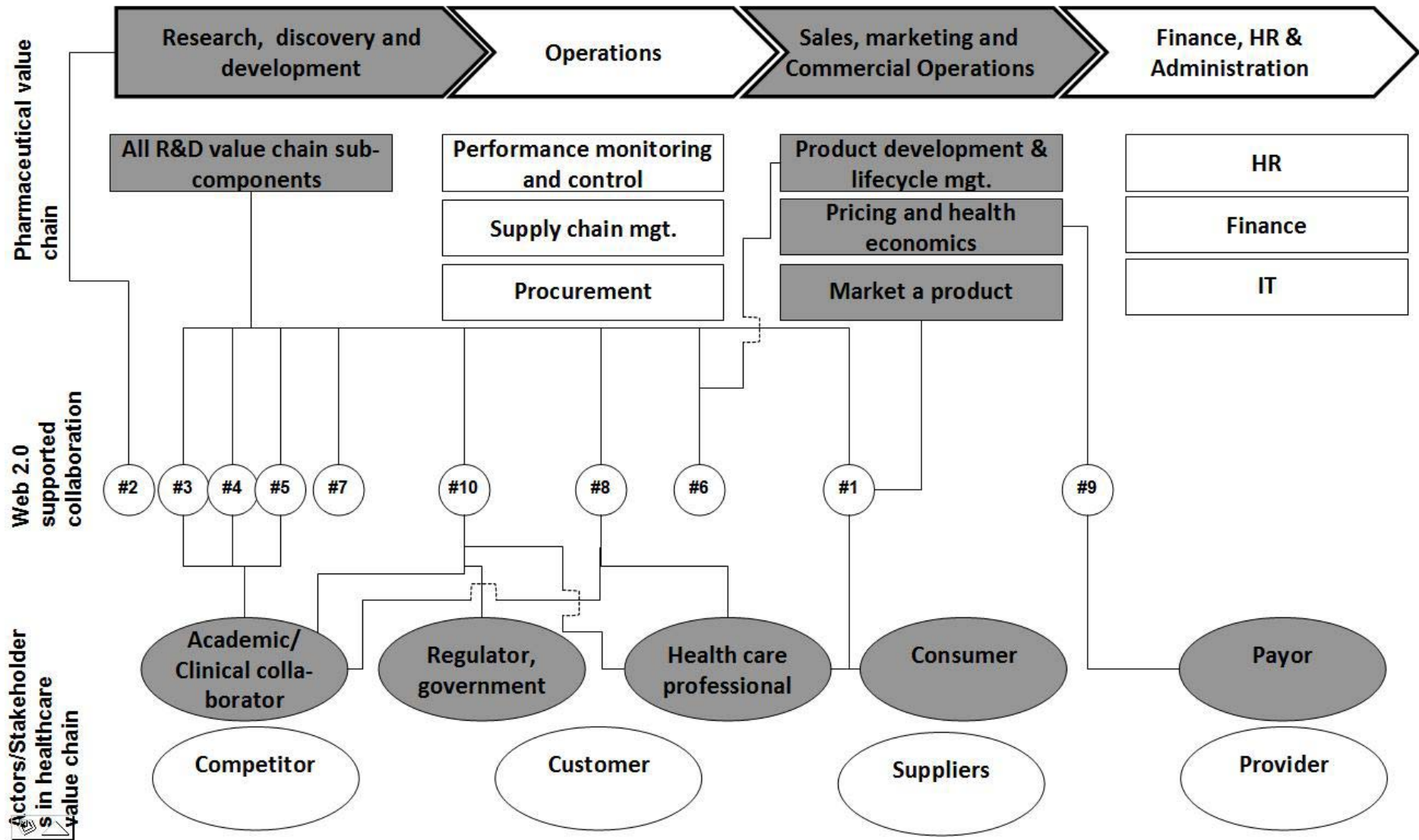
Where a collaborator was selected to participate in one or more initiatives, they are shown in grey. Internal collaborators are shown in rectangular representations above, external in ovals below. The connecting initiatives as detailed in table 3 are shown by number. Note that while this was a typical representation of the value chain used by the company, it should not be considered sequential. Rather this figure serves the purpose of highlighting the concentration of initiatives around R&D and Marketing, but also the number of potential future actors in other areas.

5.4.2 Research question 2: Effectiveness of opportunity identification process

In relation to research question 2, are there common structural design criteria to consider for a company to launch a democratized collaboration initiatives in Pharma, thematic analysis of the selected initiatives revealed 9 common structural design criteria shown in table 5d. Only design elements observed in more than one initiative are listed, and had to be explicitly stated in the company's documentation.

Table 5d: Structural design criteria to select democratized collaborations

Criteria type	Criteria	Example	Number of Initiatives
Collaboration Input	Leverage of external knowledge and talent	"lever external networks" "Leveraging the vast and shifting areas of scientific opportunity" "much larger universe of colleagues"	5
	Leverage of distributed knowledge	"Improve knowledge sharing and collaboration across teams and geographies" "with no geographic limitations"	3
	Leverage of heterogeneous knowledge types	"knowledge sharing… across functions/disease categories" "explore use with outside scientific community"	3
	Develop Intellectual property Opportunities	"Decrease # of bottlenecks areas where we currently have no product advantage"	2
Collaboration Process	Ideation	"Direct, two-way, insights via brainstorming activities and discussion forums" "sharing of best practice ideas" "Decrease time of idea generation"	4
	Co-creation	"collaboration and problem solving using on-line tools to create solutions between remote teams" "user-created knowledge"	2
Collaboration Structure	Peer-peer	"Explore partnership(s) with leading …."	3
	Many-one	"closed online community… discussions driven by the company"	2
	Third party	"[lever] third party open innovation platform"	2

Certain terms identified in this analysis should be defined. Co-creation is characterized by the fact that participants work together on the same product. Ideation, by the fact that participants share ideas, but is not necessarily a usable product or solution. By structure of collaboration, this could be that all participants are peer-peer (identical roles such as in Wikipedia), many-one (a dominant participant organizes a group, such the company running a closed online community), or many-one-many (a third party such as Innocentive is an agent acting as go between participants).

5.4.3 Research question 3: Democratized collaborations in normal operating strategy

Support for research question 3 was inconclusive in our study; we were unable to clearly determine if democratized collaborations could be easily included as normal operating processes (as opposed to be treated a isolated projects and monitored by top management). All selected initiatives were approved by the board and had a senior business sponsor. Some initiatives, such as initiative 1 using online consumer and healthcare professional communities, can be considered in the late pilot stage with evidence for success and benefits. This could be considered an initiative already integrated into normal business processes. However, it was only possible to value 2 initiatives with a clear business case, and generally it was not possible to value these initiatives save with an approximate potential. The inability to develop clear business cases for initiatives and clearly define benefits meant that initiatives could only be approved by clear consensus, and were still treated as special projects.

5.5 Discussion

Table 5e below summarizes the main findings of our study as related to our main research questions.

Table 5e: Summary of results

Research question	Results
1) Are democratized collaborations applicable to the pharmaceutical value chain, to more than one part, and with both internal and external participants?	• Highly relevant • Specifically in sub-sections of the R&D part of the value chain, and Sales & Marketing (Product Development and Life Cycle Management, Pricing and Health Economics, and Market a Product) • Most internal actors are potential participants, and amongst external participants academic or clinical collaborators, regulators, health care professionals, consumers and payors are potentially important
2) Are there common structural design criteria to consider for a company to launch a democratized collaboration initiative in Pharma?	• Collaboration inputs (Use external knowledge and talent, connection of distributed knowledge, cross pollination heterogeneous knowledge types, Intellectual property opportunities) • Collaboration Process (Ideation, Co-creation) • Collaboration Structure (Peer-peer, Many-one, Many-one-many)
3) Can democratized collaborations be included normal business processes, as opposed to be treated a special projects and monitored by top management?	• Inconclusive, however suggests that inability to clearly define benefits prevents inclusion in business as usual strategy

Our first finding is that Web 2.0 has significant potential in the R&D part of the value chain is not surprising given the attention that open source has received in various areas of biotechnology. More surprisingly, we find that this pharmaceutical company seeks to extract value from new, rather than existing, democratized collaborations. Additionally, many of these opportunities lie outside R&D and focus on collaborations with participants outside the company itself. Finally, we find common structural design criteria in inputs, process and structure across the design of these initiatives. To assess the robustness of these criteria, we will firstly examine if the criteria in this study can also be identified in literature. Secondly, we will identify appropriate structural design criteria identified in literature that was not identified in our study.

In examining the input criteria, we find that in general, equivalent or related concepts exist for input criteria. The concepts of lead users, scalability or critical mass (von Hippel, 2005: 19-31) are compatible with our more generalized term *leverage* of knowledge and talent, in of search both

external knowledge or internal knowledge that is distributed around the organization. Its importance in both this study and literature suggests that the search for talent is at the heart of democratized collaboration design. While intellectual property (IP) and product issues were addressed in our initiatives, the analysis by managers was not as detailed as that of Chesbrough (2006). He explores factors such as the potential rewards either by licensing, constructing a distinctive IP position, and the cost of completing research internally (Chesbrough, 2006 : 81-89). However, we believe that a number of these factors would not have been stated in the company's design documentation, such as the general high cost of pharmaceutical development, and we believe our results are consistent with general literature.

In addressing collaboration processes and structure, the initiatives did not fall naturally into Tapscott & Williams' trends in *Wikinomics* (2006). However we argue that by examining collaboration process and structure (rather than trends), we can better understand the decisions needed to design these collaborations. Collaboration processes including co-creation, ideation (use of ideagrams) and different structures (peer to peer, many to one) can be used to explain all but one of the trends. For example, trends such as prosumer, where Lego (Tapscott & Williams, 2006: 130-132) is a commonly cited as an example, is a co-creation with a many-one structure of collaboration. Lego provides regular releases of Mindstorm, a tool for consumers to design Lego end products (i.e., "many" consumers have a relationship with the "one" of Lego). Hence the structural design criteria found in this study are compatible with general literature, and believe the more flexible definitions of process and structure are more appropriate for explaining the phenomena.

Despite these commonalities, two distinct structural design criteria are observed in general literature on democratized collaborations which were not identified in this study. First there is Tapscott & Williams' trend of scientific collaboration (New Alexandrians), where participants do not work on exactly the same idea, but rather build on each other's ideas in a more modular manner. It is similar to academia where people cite and give credit to other's work. Secondly, the sharing or capture of the benefits or the end product was also not identified. We suggest the fact that scientific collaboration was not documented in the study may reflect either that these initiatives were in the early stages of development, and they may mutate into this form at later stages. Additionally managers would not have seen scientific advancement and objective in itself for a company. Hence our results do not imply that the scientific collaboration (New Alexandrians) trend does not apply to a more generalized framework.

The absence of the design criteria of sharing and defining benefits capture is more significant, and it was not explicitly stated in any of the initiatives. It is a well documented structural design criteria in various literatures, such as the "commons" concept clearly articulated in the GNU GPL license in open source software "*to which anyone may add but from which no one may*

subtract" (Mahony, 2003 : 1194). Furthermore, being able to define the problem/solution space has been observed to be a key success factor, as modularized solutions rather than big ideas can allow parts of the value to be extracted along the course of the collaboration (Baldwin & Clark, 2005). Additionally exploiting a "long tail" of solutions or a series of customizations exploited at low cost ("*Low cost innovation niches*") is also advantageous (von Hippel, 2005 : 63-66). While not explicitly stated in the company's documentation, our participation in the selection process leads us to believe that the benefits of 4 initiatives would be "commons", sharable and exploitable by all participants. We hypothesize that lack of reference to benefits sharing in our study is related to the fact that many of the initiatives were not yet included in normal business processes, and that managers saw them as strategic bets, and would look at benefits capture as these collaborations evolve. Hence this does not eliminate these criteria as relevant to general democratized collaboration design.

This discussion leads us to propose a generalizable set of structural design criteria for launching democratized collaborations across sectors as shown in figure 5b. In addition to the 9 criteria identified in this study, a scientific process and 5 criteria for benefits sharing and capture are added. It should be noted that we do not suggest this as a proven or complete set of structural design criteria, but rather a framework to be tested and validated by further research.

Figure 5b: Overarching criteria of democratized collaboration design

Area	Observed patterns
Inputs	
• Leverage (of knowledge and talent)	⑤ Distributed knowledge in org.
	③ External talent or knowledge
	② Heterogeneous knowledge in org.
• Intellectual property (or products)	② Enhance weak position where R&D costs are high
Process and structure	
• Structure	③ Peer to peer
	② Many-to-one
	② Many-one-many (e.g., Third party organized)
• Process	④ Co-creation
	② Ideation
Benefit sharing and capture	
• Benefit sharing regimes	⊝ "Commons": deployment (support), hybridization (add-ons), complements or self service
	⊝ Other: licensing, IP ownerships
• Benefits capture potential	⊝ Modularized (benefits extractable along bit by bit)
	⊝ Long tail" or many potential niche solutions
	⊝ Big Idea or undefined

5.5.1 Implications for theory and managerial practice

The main implications for theory derive from the fact that the current literature is limited in its focus on technology and media sectors. For example, our analysis of *Wikinomics*, *Open Business Models* and *Democratizing Innovation* identified 52 separate cases that were elaborated sufficiently to understand the collaboration dynamics, but over 60% were in the technology or media sectors, and 30% were identical cases between the literatures. Hence, in deepening the understanding of democratized collaborations' application to the pharmaceutical sector, we have found that a large part of the structural design criteria are still hold. In addition, our findings support the literature in suggesting that common structural design criteria across sectors may be appropriate, and should be an ongoing focus for research.

Two main implications emerge for management. Firstly, an understanding of the potential collaboration space in the pharmaceutical industry is gained, and secondly the fact that managers find it difficult to express or quantify benefits capture. In examining the potential democratized collaboration space for Pharma, we should recognize that stakeholder relationships between the pharmaceutical companies and the health care industry have been widely studied, such as by Herxheimer (2003). However there is not a full mapping of these relationships, as they often vary between regions and markets, and implications for designing democratized collaborations have not been specifically addressed. However, it is not surprising that managers look for these relationships as the sources of innovation in communities lie on the interface of the organization and its environment (Brown & Duguid, 2002). Hence, this mapping of the potential external participants provides managers with indications of where they may extract significant value through democratized collaborations.

Secondly, the lack of explicit attention on how to capture the benefits represents a potential risk to these initiatives, and indicates that some design guidance is required by the managers beyond the use of case examples. Managers need to pay explicit attention, though not necessarily at the early development stage, on how benefits will be shared and captured. Furthermore, this lack of early detail on benefits capture means that democratized collaboration initiatives cannot immediately be included in normal operation processes.

5.5.2 Potential limitations and future research

In offering these results as a sound research, we recognize the potential bias involved in a research project primary directed by the company itself. Two potential major risks arise, bias involved in the proprietary framework built via *Wikinomics* (Tapscott & Williams, 2006), *Eight business technology trends to watch* (Manyika, Roberts, & Sprague, 2007) and general web searches, and bias in the fact that the company self-selected the project and was pre-disposed to completing a democratized collaboration strategy. The first is mitigated by the fact that there is

currently no accepted and exhaustive framework for describing Web 2.0, and the case library developed in conjunction with the company, and based on broad academic literature, serves the purpose of introducing key trends. The second is not seen as a significant source of bias, as 3 of the company's division withdrew from the assessment after the initial interviews identified no clear opportunities, implying that the company only selected initiatives where true opportunities existed.

We also recognize the limitations of combining the structural design criteria of this study with general literature, as they are in two different contexts, but do so as no generalized framework exists. There are specific limits to its generalizability. Firstly, the initiatives launched by the Pharmaceutical company are in their early phases and it is impossible to determine if they will be ultimately a long term success. They are also specific to this particular company. For these reasons, research needs to examine further both cases of failure and success to offer more empirical evidence for the relative strength of these criteria in determining outcomes.

5.6 Conclusion

Democratized collaborations clearly have the potential to add value to pharmaceutical industry, where there is a clear drive towards more open business models. Our study highlighted 10 examples weighted in the R&D and Sales and Marketing processes. Furthermore, we demonstrated the use of case examples as a powerful tool for assessing the opportunities for democratized collaborations based on Web 2.0. This study shows that in a rapid assessment, large companies can move beyond idea generation and gain consensus on priority initiatives, including finding senior management willing to be responsible to own and execute ideas, and develop early pilots.

Our study further identified 9 structural design criteria to be examined by managers considering democratized collaboration. The comparison to general literature demonstrates that a general framework for designing democratized collaborations still needs to be established. Current literature has emphasized open source cases using significant empirical evidence. However, a number of commonalities found between our Pharma case and extant literature weighted on technology and media sectors suggest that a generalized framework might be possible. If democratized collaborations become more important across a wide range of industries, it will certainly become desirable to managers. To understand further how these collaborations should be designed, research needs to examine further case examples of failure, and the relative importance to success of each of these structural design criteria.

6. Knowledge Arbitrage in Pharma

Hughes, B., Wareham, J.Knowledge Arbitrage in Global Pharma: a synthetic view of Absorptive Capacity and Open Innovation. *R&D Management (forthcoming)*.

Abstract

This case study examines a global pharmaceutical company widely using open innovation (OI). Three main research questions are addressed: (1) what OI concepts are salient in their innovation portfolio?, (2) what OI concepts are used in the strategy formulation? and (3) what other concepts are present that augment OI? Interviews with 120 managers and archival documents were analyzed using thematic analysis. Two concepts prominent in literature, (i) value capture models and (ii) technology evaluation criteria, were not present in this portfolio. By contrast, we found a focus on OI capability building, external information sharing and uncertain knowledge arbitrage in networks. Finally, we discuss these capabilities in relation to absorptive capacity, proposing a simple, but important bi-directional perspective to embrace OI.

7. Managing eHealth

Hughes, B. Managing e-Health in the Age of Web 2.0: The Impact on e-Health Evaluation. *In Mohammed, S., & Fiaidhi, J. (editors) Ubiquitous Health and Medical Informatics: The Ubiquity 2.0 Trend and Beyond (forthcoming).*

Abstract

The use of Web 2.0 internet tools for healthcare is noted for its great potential to address a wide range of healthcare issues or improve overall delivery. However, there have been various criticisms of Web 2.0, including in its application to healthcare where it has been described as more marketing and hype than a real departure from previous medical internet or eHealth trends. Authors have noted that there is scant evidence demonstrating it as a cost efficient mechanism to improve outcomes for patients. Moreover, the investments in Web 2.0 for health, or the wider concept of eHealth, are becoming increasingly significant. Hence given the uncertainty surrounding its value, this chapter aims to critically examine the issues associated with Web 2.0 the merging use of Web 2.0 for health. We look at how it not only distinguishes itself from previous eHealth trends but also how it enhances them, examining the impact on eHealth investment and management from a policy perspective, and how research can aid this management.

Key words

Healthcare Informatics, Internet, eHealth, Medicine 2.0, Web 2.0, Electronic Health Record, IT investment evaluation

Recommended further readings

There is over 500 references in this document, many of them related to analyses performed in the studies. Hence, I provide this section to give readers a short list of "essential" readings on the most explored topics. Clearly any such choice is subjective, but should help the tim-pressed reader to quickly grasp a specific subject.

Web 2.0 and social computing

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Annexes

Annex 0: Health 2.0 Wikipedia page

Note: The "Health 2.0" Wikipedia page is top of search engine ranking; Reference [4] is quoted from study 2 of this thesis

Annex 1: Supplementary data to chapter 1

Annex 1.1: Web 2.0 Literature and key issues observed or questions raised

Subject	Papers	Key questions and issues
Internet information structure and application design with web 2.0	Hendler & Golbeck (2008); Bojars et al. (2008); Rahwan (2008); Battle & Benson (2008); Ankolekar et al. (2008); Angus at al. (2008); Greaves (2007); Tenenbaum (2008); Lin (2007); Ramamritham al. (2008); Stearn (2007); Kulathuramaiyer (2007); Oren et al. (2007);	• Striking the balance between semantic and social based information structures, and extracting value from the two (all) • How to combine web 2.0 and web semantics to drive value (Hendler & Golbeck, 2008; Tenenbaum, 2008), such as through REST (Battle & Benson, 2008), SIOC and FOAF (Bojars et al., 2008), systems of electronic argumentation to make the more effective (Rahwan, 2008) • Problems of categorizing and searching for relevant data in the created content (Hendler & Golbeck, 2008), • Issues of how to "trust" online data (Ankolekar et al., 2008) • Need for simple scalable systems (Lin, 2007), addressing some security issues (Stearn, 2007) • Employing a mashup for digital journals (Kulathuramaiyer, 2007)
Learning and education (eLearning 2.0)	Dron (2007); Lee et al. (2008); Hedberg & Brudvik (2008); Alexander (2008); Artal et al. (2008); Wiberg (2007); Klamma et al. (2007); Huang & Behara (2007); Zhang et al. (2007);	• Susceptible to intentional attack (Dron, 2007) • Influence of a few (those who make first contributions) is disproportionately large, known as the Matthew principle (Dron, 2007) • Digital social networks change agency of people by the visibility of 'things', through how they are created, managed and framed in discourses (Klamma et al., 2007) • Wisdom of crowds becomes the stupidity of mobs (Dron, 2007) • Pre-Web conceptions of social space, privacy and intellectual property are being challenged (Alexander, 2008), with issues of trust that is intricately related to privacy and security
Health and Medicine (Medicine 2.0)	Giustini (2006); Boulos & Wheeler (2007) ; Sandars & Haythornthwaite (2007); McGee & Begg (2008); Downes (2007); Murray (2007);	• Technological *and* social phenomenon (Boulos & Wheeler, 2007) • Raise awareness of Web 2.0 tools and the possibilities, such as through training, and address inequalities in use for older users (Sandars & Haythornthwaite, 2007) • Issues of data quality, IP and adverse use patterns such as addiction (Boulos & Wheeler, 2007) • burden of hackers, viruses, hoaxes, adverts and spam that continue to proliferate unabated Downes (2007) • Issues of Collective wisdom or madness (McGee & Begg, 2008) • Copyright, fair-use, privacy issues (McGee & Begg, 2008)
Information system use, potential, and	Jones (2008); Fu et al. (2008); Hsu & Lin (2008); Daugherty et al. (2008);	• Tools structural features can produce unique collaboration and authoring patterns Jones (2008) • Identifying the motivational reasons for creating such media also becomes increasingly important (Daugherty et al., 2008) - users have doubts over Web 2.0 tools, that they seek to minimize, thereby

impact (web 2.0 in different contexts)		growing relationships with the Web 2.0 objects by community identification (Hsu & Lin, 2008) • Different mixing patterns between Web 2.0 tools, such as disassortative for blogging, and assortative for social networks (Fu et al., 2008)
Organizational, social, and research implications of Web 2.0	Zammuto, et al. (2007); Parameswaran & Whinston (2008); Beer & Burrows (2007)	• Requiring a marriage of information and organizational scientist in order to understand phenomena such as virtual and mass collaboration (Zammuto, et al., 2007) • Requires a rethink of how we organize and individuals roles within organization (Zammuto, et al., 2007) • Issue of intellectual property rights (IPR), free riding or third party use of common's material, is contentious (Parameswaran & Whinston, 2008); • Values of privacy that people attach to online Web 2.0 information (Beer & Burrows, 2007)
Library management (Library 2.0)	Lankes et al. (2008); Liu (2008); Stephens (2007);	• Operational, technical and policy challenges to capture potential, plus a number of Ethical issues around the exercising control of conversations in social tools (Lankes et al., 2008)
Marketing and advertising using Web 2.0	Cooke & Buckley (2008); Riegner (2007).	• Potential of interactive research and the understanding of communities, looking at them as `complex adaptive systems' (Cooke & Buckley, 2008) with a potential to influence consumers

Annex 1.2: Calls for papers or special issues looking at Web 2.0

Journal	Special issue	Sample topics themes
International Journal of Market Research : Publish date - late July 2008	Web 2.0 and Social Networks: The implications for market research (http://www.marketresearch.org.uk/publications/downloads/IJMRCallResearch20.pdf)	• Where is the market research industry heading in this Web 2.0 world? • How can we be 'confident' in web 2.0 research findings? • Do we need new metrics to give us confidence in our research? • Will research adopt open source thinking and approaches as is happening within marketing? • What are the ethical implications of Web 2.0?
Australian library journal : Publish date - August 2008	Web 2.0 and the library and information science profession (http://beyondthehype.ning.com/forum/topic/show?id=898927%3ATopic%3A8983)	• How is web 2.0 being used in the many different library and information science contexts? • What are the challenges (i.e. ethical, legal, financial) in using web 2.0 within service design and delivery? • What skills and knowledge are needed by librarians and information professionals if they are to successfully meet the challenge of using web 2.0 for service design, development and delivery? • When is web 2.0 appropriate for use within the design and delivery of services? When is it not?
Annals of Information Systems : Publish date - September 2008	Semantic Web & Web 2.0 (http://www.sfu.ca/~dgasevic/cfps/SemWeb2/)	• Ontologies and semantic annotations for Web 2.0 content and applications • Collaborative tagging and folksonomies vs. semantic annotations • Semantic social networking or Semantic technologies for enabling reasoning in Web 2.0 applications
Journal of medical internet research (ISI IF 3.0) : Publish date - October 2008	Medicine 2.0 (http://www.jmir.org/2008/3)	• Medicine 2.0 - How social networking and Web 2.0 technologies revolutionize health care, wellness, clinical medicine and biomedical research
Journal of MIS Research : Publish date - October, 2008	Information Systems Research and Practice in the era of Web 2.0	• Management of Web 2.0 technology in organizations • Use of Web 2.0 in managing IS resources • Applications of Web 2.0 technology in virtual teams and knowledge management
Electronic Commerce Research and Applications (ISI IF 0.6) : Publication date - late 2009	Social Networks and Web 2.0 (http://www.elsevierscitech.com/pdfs/ECRA_CFP_SocialNetworks.pdf)	Describing and evaluating innovative Web 2.0 technologies, along with novel strategies and methods for building and managing such applications.
International Journal of Web Based Communities :	Web 2.0 Goes Academia: Innovative Scenarios for Socio-technical Communities	• What Web 2.0 applications exist in universities, in research or in learning? • Do Web 2.0 applications in academia make a difference to existing Internet applications like email, content management systems or newsgroups?

Submission due - 18 July, 2008	(http://www.inderscience.com/browse/callpaper.php?callID=972)	• How can we introduce Web 2.0 applications in the academic world? • What is the negative side of Web 2.0 in Academia with respect to plagiarism and "Wikipedia-only" references in student theses?
Interactive Learning Environments : Submission due - 11 August, 2008	Web 2.0 for Interactive e-learning (http://www.tandf.co.uk/journals/cfp/nilecfp.pdf)	Blogs and multimedia database systems; Browser-based Web applications (Ajax); Folksonomy, taxonomy, and tagging; Identification of communities of practice; Internet telephony, instant messenger, and multimedia social interaction; Social network theory and social network analysis etc.
International Journal of Human-Computer Studies (IS IF 1.36) : Abstract submission - 30 Sep. 2008	Measuring the Impact of Personalization and Recommendation on User Behavior (http://www.configworks.com/IJHCS/index.html#SUBMISSION)	"…new techniques are being proposed, for improving the prediction accuracy or offering new ways for users to participate, as in social networks in Web 2.0 platforms…this special issue seeks to foster scientific work on understanding how personalization and recommendation impact user expectations, beliefs and behavior during and after the interaction… "
Learning, Media and Technology : Submissions due October 31st 2008.	Learning and social software - researching the realities (http://www.sport.leisurestudiesarena.com/journals/cfp/cjemcfp.pdf)	• Social software use and informal learning; • How social software applications 'fit' with formal educational settings and communities of educational users - not least existing forms of pedagogy, curriculum and assessment • When and for what purposes are social software applications are being used by learners
Identity in the Information Society : Submissions due – 31 October 2008	Social Web and Identity (http://www.springer.com/computer/programming/journal/12394)	• How these Identities are constructed and in particular what are the different components of these Identities? Who is in control? • What are the mechanisms / technologies that intervene in the construction of these Identities (such as Web 2.0 technologies, social translucence), and other services that have appeared (Examples: Social aggregators, eraser services, etc.)?
Decision Sciences Journal : Submissions due November 15, 2008.	New Frontiers in Collaborative Decision Making (http://www.irit.fr/CDM08/contenu/CFP_decision_science.pdf)	Some of the well-known IT tools developed in this arena and used extensively today include web 2.0, social networks, wikis, multi-player games, and virtual team environments…. Topics of Interest for this special issue on the use of IT tools to support collaborative decision making include, but are not limited to 1) evaluating the current state of the field, 2) reviewing, extending, and developing theoretical paradigms linking these fields; or 3) New IT models, techniques to enhance collaborative decision making;
Journal of Information Systems Education : Submissions due - January 20, 2009	Impacts of Web 2.0 and Virtual World Technologies on IS Education (http://www.jise.appstate.edu/Issues/19/V19N1P4.pdf)	Research studies, instructional cases, teaching tips, and other discussions that examine the role that Web 2.0 and Virtual World technologies should - or perhaps should not - play within our physical, virtual, or mixed classroom environment.

Information systems research : Submissions Due - February 6, 2009	The Role of Information Systems in Healthcare Organizations: Synergies from an interdisciplinary perspective (http://www.informs.org/site/ISR/article.php?id=124)	Includes the role of Internet and Web 2.0 technologies in creating, accessing, and sharing healthcare related information among patients and providers.
IEEE Intelligent Systems (ISI IF 1.4) : Submissions due - 5 March 2009	Transforming E-government and E-participation (http://www.computer.org/portal/site/intelligent/menuitem.924e0547aef9ed7aa84840898bcd45f3/index.jsp?&pName=intelligent_level1&path=intelligent/content&file=EgovCFP.xml&xsl=generic.xsl&)	*"Toward this end, interest is growing in the benefits that emerging technologies (for example, the Semantic Web, Service-Oriented Architecture, Web 2.0, and social computing), tools, and applications might provide to this challenging domain. This interest is reflected in initiatives and projects in both Europe and the US"*

Annex 1.3: Web 2.0 issues in 30 days of online press

Focus area	Issue	Total	Sources	Examples
Security and Cyber-criminality	Security, including the privacy of the individual's or an organization's data, and potential denial of services for a Web 2.0 site via criminal attack	14	Computer Weekly, (2008); Lawlor (2008); Levitt (2008); Ragan, S. (2008); Trusted source (2008); Savvas (2008); Hulme (2008); Marshal, (2008); Rieger (2008); Help net security (2007a;2007b); Germain (2007); Martin (2007); Brenner (2007); Celent. 2008.	• Technical security Vulnerability in hosting packages for Web 2.0 site (e.g., ruby) or MTV France sending malicious code via RSS (Trusted source, 2008) on myspace (Savvas, 2008), or "Secret Crush" or "My Admirer" attacks on facebook • Internet fraud and using social networking sties for phishing attempts (Levitt, 2008; Marshal, 2008)
Externality of transparency	The openness of web 2.0 tools and data causing the unintended consequences	10	James (2008); Business week. (2008); Schick (2008); Wiehl (2008); Saran (2008); Mitchell (2008); Miller, J (2007); Miller, N (2007);	• Unintended consequences of transparency of social media, such as the friending of facebook and Microsoft employees days in advance of Microsoft's $240 million investment in the social network (Business week, 2008) • Posting confidential company data by users either intentional or be accident (James, 2008; Saran, 2008) • Use of facebook profiles to assess job candidates (Wiehl, 2008; Miller, J., 2007) or the pitfalls of criticizing future potential employers (Mitchell, 2008).
Moral and relativistic conflicts	Moral and relativistic conflicts of competing rights playing out in the	6	Jesdanun (2008); Aleo-Carreira (2008); Wagner (2008); Morphy (2008); Musharbash (2008); Haines (2007).	• Yahoo removing pictures of children smoking (Jesdanun, 2008), unrelated communities meeting via the net and clashing over relative values such as over pornography, or legal charges against Wikipedia for displaying Nazi-symbolism (Haines, 2007). • Threat of terrorism coordination through the use of Web 2.0 tools (Wagner, 2008), such as the Al-Qaida advice column (Musharbash, 2008). • Battle between companies and governments on the one hand, and free speech organizations on the other, to maintain open the whistleblower site wikileaks.org (Morphy, 2008).
Threats to vulnerable groups	Increased issues with vulnerable groups or general consumer	5	Steffen (2008); Hopkins (2008); Donnelly (2008); Tindal (2008); Jewitt, H.	• Risks to youth are associated with contact by sexual predators, cyber-bullying by peers and misuse of personal information (Tindal, 2008; Uitcaod, 2007) or vulnerable groups such as those with eating disorders (Donnelly, 2008).

	protection		(2007); Uitcaod (2007)	• Cyber bullies, including the abuse of university staff by 350 students on facebook (Jewitt, 2007). • e-book marketers using twitter to promote their products (Hopkins, 2008)
Effective use of resources	Capturing the power of Web 2.0 for constructive forces rather than only for social amusement or addiction	5	LaMonica (2008); Asay, (2008); Matthews (2008); Amis, (2007); Booth (2007).	• Self-admitting Facebook addicts who note that much of their time online is non-productive even for pursuing purely social objectives (Asay, 2008) T • The need for precise strategies to profit for social networking in professional contexts, rather than wasting time (Amis, 2007; Booth, 2007).
Information overload	Information overload and quality, including the risk of generating huge amounts of information of poor quality	3	Hurd (2007); The Economist (2007); Eye for Travel (2007).	• Fragmentation in online travel websites (Eye for Travel, 2007) • Difficulty in finding accurate online user generated health information, with 3% of user reporting harm (The Economist, 2007)
Unequal or adverse influences (of mass opinion)	Low participation rates or control of Web 2.0 resources leading to the influence of the few over the "mob"	3	Newcombe, (2008); Herbert (2008); Townend, (2008);	• Facebook not providing support to Hillary Clinton group in U.S election (Herbert, 2008) • Low participation rates but high readership (Newcombe, 2008) • Control of religious forums on Facebook by different churches (Townend, 2008)
Web 2.0 user and the workplace	Individuals rights to use and when using Web 2.0 in the workplace, such as their employer's right to own any content added to web 2.0	2	Bruce (2008); Paton (2007).	• Ownerships by the firm of any material created online, such as using sites during the lunch hour (Bruce, 2008; Paton, 2007).

Annex 1.4: Dates and sources of analysis of online news on web 2.0 and identifying web 2.0 issues

Corresponding date (2008)	Total	# with issues identified	News sources
July 25th, 2008	67	2	Darkreading, Daily News Eygpt.
July 7th, 2008	94	7	Government Technology, NZ Herald, vnunet.com, CNET news (x2), Computer Weekly, World Changing
July 2nd, 2008	135	3	Huffington Post, Computing News, News Factor Business Report,
June 25th, 2008	140	2	Profy.com, Techherald.com, eyefortravel.com
June 23rd, 2008	130	1	Mail & Guardian online
June 18th, 2008	189	3	Trustedsource.org, Social networking news, PC World, Business week
June 10th , 2008	80	0	
March 25th, 2008	45	0	
March 10th, 2008	82	1	Newsquest's Sunday Herald
March 5th, 2008	82	0	
February 28th, 2008	90	2	Information week, Mac News world.
February 26th, 2008	120	1	Telegraph.co.uk
February 23rd, 2008	32	2	Fox News, ZDNet.com
January 24th, 2008	104	1	Computer weekly
January 16th, 2008	116	2	Information week. Der Spiegel
January 10th, 2008	85	5	Marketwire, Media Syndicate, Computer weekly, Scientific American, Help Net Security
January 8th, 2008	112	0	
December 28th, 2007	75	2	Help Net Security, Rismedia
December 25th, 2007	74	0	
December 18th, 2007	120	3	E-commerce Times, Web Pro News
December 9th, 2007	36	0	
December 8th, 2007	55	1	The Register.
November 26th, 2007	105	1	Management-Issues
November 8th, 2007	116	1	uticaod.com
October 17th, 2007	155	3	Information Week. SearchSecurity.com, The Age
September 16th, 2007	145	0	

September 6th, 2007	122	1	The Economist
August 31st, 2007	59	1	Theinquirer.net
-august 24th, 2007	77	0	

Annex 4: Supplementary data to chapter 4

Annex 4.1: Types of empirical studies in cognitive search and information credibility

Focus	*Paper*	*Sample & setting*	*Method*	*Result*
Action search models or moves	Tauscher and Greenberg (1997)	19 University staff and students and 9 company staff	Log-file analysis, patterns of visits and revisits to websites	First time visits; revisits; authoring of webpages; use of web-based applications; hub-and-spoke visits; guided tours; depth-first searches
	Schacter et al. (1998)	32 School children	Log-file analysis of search engine results	Analytical searching using search terms; browsing by clicking on hypertext; scan-and-select through search engine results
	Byrne et al. (1999)	8 Unspecified	Concurrent verbal protocol Analysis *of real web use*	Six top level categories of use (Use information; locate something on a webpage; provide information; configure web browser; react to environment)
	Holscher and Strube (2000)	24 Students	Log-file analysis and interviews	Following hyperlinks; using search engines; generating queries; examining search results; selecting search results; reformulating queries; going to known website directly
	Choo et al. (2000)	34 Unspecified *users from companies*	Log-file analysis and Critical Incident interviews	Starting (using ''portals'', intranet homepages; go directly to a webpage); Chaining (following hyperlinks); Browsing (examining page headings and viewing sitemaps); Differentiating (bookmarking webpages; printing webpages; copying contents); Monitoring (revisits); Extracting (systematically searching through a website)
	Dennis, 2002	57 Undergraduate students	Researcher defined task; questionnaire, observation	users prefer to use queries of about three terms in length. Cognitive load can be measured did not differ across search mechanisms (query-based Internet search via the Google search engine, directory-based search via Yahoo, and phrase based query reformulation-assisted search via the Hyperindex browser)
	Johnson et al., 2004	10,000 households	Log file analysis	shoppers search very few sites in a given shopping month, and search evolves, and, perhaps, shoppers learn to search over time via mild evidence of time-varying dynamics, where search decreases over time.
	Griffiths, J. T. and Brophy,	38 students	Surveys	"Googling": Students prefer to locate information through search engines "First page": Rarely interested in anything other than the first 10 results, as

	P. (2005)			usually fir for purpose
	Jansen, B. J., & Spink, A. (2006).	9 Studies looking at search engine logs representing 300 million Web searching sessions	Log file analysis	(1) users are viewing fewer result pages, (2) searchers on US-based Web search engines use more query operators than searchers on European-based search engines, (3) there are statistically significant differences in the use of Boolean operators and result pages viewed, and (4) one cannot necessary apply results from studies of one particular Web search engine to another Web search engine.
	Pan et al. (2007).	22 Students	Eye tracking and observational data	College student subjects are heavily influenced by the order in which the results are presented and, to a lesser extent, the actual relevance of the abstracts. These subjects trust Google in that they click on abstracts in higher positions even when the abstracts are less relevant to the task.
Cognitive search	Catledge and Pitkow (1996)	107 University staff and students	3 weeks log-file analysis	Search browsing; general-purpose browsing; serendipitous browsing; homepages as indexes
	Navarro-Prieto et al. (1999)	23 students	Retrospective verbal protocol Analysis	''Top-down'' searching (searching in general area then narrowing down the search); ''bottom-up'' searching (searching in narrow area then broadening the area); ''mixed'' searching
	Kim (2001)	5 Students	Screen display recordings	''Spoke-and-hub pattern''; ''breadth first'' (checking multiple search results); ''depth first'' (going several steps away from search results before returning)
	Fidel et al (1999)	8 High school children	Concurrent verbal protocols, observation, and interviews	''Intuitive scanning'' (''landmark searching'' and ''returning to the search engine''); ''analytical''; ''known site''; ''empirical''; ''similarity''; ''focused searching'' and ''swift and flexible''
	Wang et al. (2000)	24 Graduate students	Concurrent verbal protocols	Search engine starting; link-following; known page searching; ''hub-and-spoke pattern
	Lazonder (2000)	14 students	Think out loud, observation	Minimal differences between experts and novices. On the simple task, experts tended to be more proficient in selecting and executing a search strategy. However, these differences decreased as the search task became more complex.
	Lergier and Resnick (2001)	60 Unspecified	Concurrent verbal protocol analysis of search engine results	''Self-terminating''; ''exhaustive''

	Cothey (2002)	206 students	10 months log-file analysis	'Search querying''; ''link clicking''
	Kim & Allen (2002)	80 Unspecified	Researcher defined task; observation and think out load	Strong dependence on tasks type with an interaction with cognitive style
	Papastergiou, 2005	340 high school students	questionnaire and a drawing task	simplistic, utilitarian rather than structural mental models of the Internet
	Ford, Wilson, Foster, Ellis, & Spink, (2002)	111 students	Interviews	Field-independent individuals will be more analytic in their behavior, Holists will display more exploratory behavior
	Jaillet, 2004	37 Unspecified	Researcher defined tasks; observational and log file data	Subject matter experts use different sites and search patterns
	Ford et al. (2005a;2005b)	68 Graduate students	Log-file analysis of search engine use for assigned topics	Differences in the use of search style (Boolean searches; best-match searches; combined searches) with individual characteristics (cognitive style, demographics) and task complexity
	Griffiths, J. T. and Brophy, P. (2005)	38 students	Surveys	"Googling": Students prefer to locate information through search engines "First page": Rarely interested in anything other than the first 10 results, as usually fir for purpose
	Thatcher (2006;2008)	80, mainly graduate students	Log-file analysis , video recordings, interviews and questionnaires	12 cognitive search strategies, including "Safe", "Broad First", "Search engine narrowing down", "Known address search domain" etc.
Information judgments	Scholz-Crane, A. (1998).	21 students	Content analysis of essays evaluation 2 web sites	Five criteria, most students used only two in their evaluations of information quality: scope (e.g., the site provides detailed information) and accuracy
	Johnson & Kaye (1998)	308 "heavy" internet users, political messages	Surveys	Equivalent credibility of traditional and electronic media source, but both only "somewhat" credible
	Fogg et al. (2001)	1411 internet users	Surveys	Seven factors: "real-world feel", ease of use, expertise, trustworthiness, message tailoring, commercial implications, amateurism
	Rieh & Belkin	15 academics	Think out load and	Judgment on 2 characteristics, the information object and the information

		interviews	contained within it. Usefulness and goodness are the primary faces of *information quality,* cognitive authority was used more for medical tasks
Rieh (2002)	16 academics	Think out load and interviews	Judgments are based on the characteristics of information objects & sources, knowledge, situation, ranking in search output and general assumption; medicine task precipitated the use of cognitive authority.
Eysenbach, G., & Kohler, C. (2002)	21 health consumers	Focus groups, observational data, interviews	Authority of the source, references, site design. Few participants remembered where they had got the information or looked at source information.
Fox, S., & Rainie, L. (2002)	500 internet users	Surveys, focus groups	Overt commercialism, trusted third-party endorsements, site-design elements, as well as users' ability to determine the source and currency of the information posted
Metzger, Flanagin & Zwarun (2003)	356 undergraduate students	Survey/ questionnaire	Students only verify information rarely/occasionally
McKenzie, P. J. (2003).	18 Pregnant women	Interviews	Web Information: Did not blindly accept authoritative knowledge , relaying on their own experience as evidence to test the authority of another source
Fogg et al.(2003).	2500 internet users	Web site selection, Questionnaire and comparison to "experts"	Comparative evaluation of Web sites with general users looking at design look, information design/structure, information focus, company motive, usefulness of information, accuracy of information, name recognition and reputation, advertising, bias of information, and tone of writing. Compared to users health experts assigned more credibility based on the source and author.
Klein, L. R., and Ford, G. T (2003)	239 shoppers	Survey	Sources are categorized into independent and non-independent; Internet search is substituting traditional information search
Whitmire (2004)	15 Students	Interviews	Web Information via the notion of reflected judgment based on epistemological beliefs. "Absolute believes" selected information consistent with their beliefs, "transitional believers" used specific criteria to evaluate information
Liua, Z., & Huang, X. (2005).	Students	Mixed method	Web site evaluation: Undergraduate students predominantly rely on author's name/reputation/affiliation as well as website reputation for their credibility evaluation. In contrast, graduate students focus more than undergraduate students on information accuracy/quality

	Tombros, Ruthven, & Jose (2005)	24 students	Search results, think out loud, observation	Web site evaluation across different markers for useful and non-useful web pages: authority/source was listed as an important indicator only of usefulness.
	Hong, T. (2006).	84 Unspecified	Observational data, interviews	Web site evaluation in the context of interactive web sites: presence of quotations/testimonials, statistics, authorship, source reference, information currency, and information selection criteria in Web sites were positively associated with site credibility.
Stopping rules	Browne et al. 2006; Browne & Pitts, 2004	115 Students	Researcher defined task; Self reported data/notes	People utilize a number of stopping rules to terminate search, and that the stopping rule used depends on the type of task performed
User satisfaction	Wixom & Todd (2005)	465 individuals from 7 different industrial organizational	Survey	Information quality (IQ) and Systems quality (SQ) are predictors of users intention to use a system
	McKinney, Yoon, Zahedi (2003)	568 students	Survey	Information quality (IQ) and Systems quality (SQ) are variables to provide insight on user satisfaction
Medical	Bennett et al., 2004	3,347 Doctors	Survey	Critical to seeking clinical information is the credibility of the source, followed by relevance, unlimited access, speed, and ease of use. Electronic media are viewed as increasingly important sources for clinical information, with decreased use of journals and local continuing medical education (CME). Barriers to finding needed information include too much information, lack of specific information, and navigation or searching difficulties.
	Bennet et al., 2005	2200 Doctors	Survey	Family physicians found the Internet to be useful and important as an information source. They were more likely to search for patient oriented material than were specialists who more often searched literature, journals and corresponded with colleagues.
	De Leo et al., 2006	4,671 Doctors	Survey	Of the targeted site types, most physicians indicate they use 1) edited/secondary data sources as their primary medical information data retrieving, 2) about one quarter of the physicians surveyed indicated research databases which provide access to medical journal publications 3) a minority of physicians use sites dedicated to their specialized area and 4) a small percentage use medical web site portals.
	Podichetty et al., 2006	277 doctors	Survey	Internet use and web based medical information is widely popular among physicians and patients. About 23%–31% of the healthcare professionals

report >80% interaction with web informed patients in their daily practice.

Annex 5: Supplementary data to chapter 5

Annex 5.1: Pharma value chain

- **R&D**; Lead generation, Lead optimization, Product realization, Global registration and marketing, R&D administration, Clinical trials (phase IV)

- **Operations;** New production development, Procurement, Planning and manufacturing, Process control, Supply chain management, Performance monitoring and control, Distribution

- **Sales, marketing and Commercial Operations;** Strategic and commercial business planning (pre-launch), Product development and life cycle management, Pricing and health economics, Information Customer and consumer services , services, Corporate development, Market a product (new and legacy), Customer relationship management, Sales management, Salesforce support, After sales services

- **Finance, HR & Administration;** Strategic enterprise management, Enterprise controlling, Financial accounting, Capital investment management, Treasury, Taxes, Human resources, Legal, Corporate communicati

Annex 5.2: Semi-Structured interview guide

Introduction (5 minutes)

 We are working with several members of the IT organization (<insert name of IT team member here> and others) to help develop the overall IT strategy for the organization under the direction of <name of corporate board member>. Our team has been asked to review the IT strategy within each division and identify IT-enabled business opportunities, as well as assist in developing and prioritizing new innovative initiatives based on the needs of the business. To do this, we are spending an hour with business leaders like yourself to understand your views on:

* The current role and performance of IT in your business
* Potential opportunities for IT value creation for the company, such as enabling existing business strategy through new technology o

Divisional Strategy (15 minutes)

Before we jump into the IT strategy, we would like to spend a few minutes to better understanding the strategy of your division.

* What are the top business priorities? What are the key opportunity areas you are focusing on? What are the key challenges you are facing?
* What are the emerging technology trends that are or will affect your business?

IT Strategy (10 minutes)

* In what ways does IT currently support your strategy? How do you feel they are doing in supporting your needs (5 very well, 1 not meeting my needs at all)? How involved has IT been in helping to drive your business strategy?
* What are the primary ways IT can help add value to your business and organization?
* How do you describe the effectiveness of ongoing initiatives? What are the commercialization/revenue prospects of the ongoing innovation initiatives? What are other impacts expected?
* We have collected a set of case examples of how IT is driving innovation in both the pharmaceutical industries and other industries, which of these are possible relevant to your division if any? How would you value them? Where will they be useful?
* What are the most important services/solutions that you receive from IT today (e.g., applications, laptop support, network/telephone)?
* How has the performance been over the last few years? Would you suggest any improvement ideas? What is your current perception of IT service?

Web 2.0 collaboration potential (20 minutes)

* How would you prioritize the initiatives we have discussed?

- What other opportunities for IT value creation do you see? Which of these, according to you, are the highest priority?

IT Delivery Model and finance (5 minutes)

- How would you describe IT's structure to support you today?

- Do you feel that IT is optimizing the right "mix" to support your needs?

- What is the current IT budget in your area? What are the areas for focused investment? Are resources adequate and wisely spent?

Conclusion

We appreciate you taking the time to share your thoughts and perspectives with us. We will be having a workshop in each division to further brainstorm and prioritize ideas. If we have any follow-on questions, do you mind if we reach out to you again? We hope you look forward to the results of this work. Thanks for your time today.

Annex 5.3: Group design references in interviews and workshops

Value chain	Potential group member identified	Counted References	Inferred Value chain sub-group
Finance, HR & Administration	Finance	8	Enterprise controlling, financial accounting
	HR	5	Human resources
Operations	Quality, compliance	1	Performance monitoring and control
	Supply chain	12	Supply chain
	Procurement	3	Procurement
Sales, marketing and Commercial Operations	Sales and marketing	15	Product development and life cycle management, Pricing and health economics, market a product
R&D	R&D	11	All
External	Customer	21	n/a
	Consumer, Patient	6	n/a
	Competitor	1	n/a
	Regulator/ government	3	n/a
	Academic/clinical collaborator	7	n/a
	Health care professional, Physician	6	n/a
	Suppliers	1	n/a

Although other divisions were not fully analyzed, two other stakeholders were commonly recognized "Payor" and "provider". These stakeholders and commonly recognized in the industry but may not have been relevant to these two divisions. The IT function has not been coded, as this was the subject of each interview and workshop.

Annex 5.4: Definitions of stakeholders or potential collaborators in healthcare value chain

- *Payor(Payer);* An agency, insurer or health plan that pays for health care services and is responsible for the costs of those services. Payers include the government (e.g. Medicare), commercial insurance and employers' self-insured plans

- *Provider;* People and/or institutions that give health care services; it includes social workers, physicians, hospitals, nurses, or any other formal health care giver

- *Customer;* Generally refers to distributors or bulk buyers of produces, such as wall-mart as a distributor of consumer health products

- *Consumer;* Generally refers to the individual receiving and benefiting from the treatment

- *Academic of clinical collaborators;* Includes all professionals involved in the research and discovery process, such as specialist Doctors who devote themselves to diseases of particular parts of the body, as the eye, the ear, the nerves, etc. (clinical trials are often conducted by specialists in the disease targeted by the candidate drug)

- *Health care professional;* Includes MDs (medical doctors) GPs (General practitioners) but also Primary care physicians, nurses, pharmacists

- *Regulator/government;* Governments, in addition to playing roles such as payor and provider, also regulate the market through organizations such as EMEA (European Agency for Evaluation of Medical Products) or the FDA (Food and Drug Administration) who are charged with ensuring that drugs sold are safe and effective

Annex 6: Supplementary data to chapter 6

Aneex 6.1: Detailed code descriptions for innovation portfolio

Group	Code	Description	Examples
Value capture business models	D	Deployment: Profiting from support, subscription, professional services	N/a
	H	Hybridization: Profiting from Proprietary extensions	N/a
	C	Complements: Profiting from another product associated with its use	N/a
	SS	Self service: user community profits for its own needs	N/a
Innovation portfolio	BAU	Business as usual (not an open innovation code)	N/a
	TT	Think tank: Speculative internal research (not an open innovation code)	N/a
	OE	Optimize execution: Look outside for options to improve and innovate	*"Reduce lead times"*; or *"Decrease # of bottlenecks areas in development processes"*; *"cost, that is 1/6 of internal R&D"*
	GO	Create growth options by placing bets to capture emerging technology	*"yielding potential directions for [new] discovery of treatments and prevention"*
Process archetype	IN	Outside-in (or in-licensing): enriching the company's own knowledge base	*"Enable ingoing knowledge from external researchers"*
	OT	Inside-out (out-licensing): Enabling profits by brining by transferring ideas to the outside environment	*"much larger universe of colleagues [by addressing] inefficient knowledge sharing so that [external] scientists can more easily ask relevant questions"*
	CP	Coupled processes: working in alliances and improving both inside-out and outside-in processes within the partnership	*"[improve] day-to-day partnership collaboration and management"*
Level of involvement	SCM	Cost and supply chain management	*"improve operational performance by collaborating with suppliers to set standards"*
	SP	Strategic partnering: short term needs to forge long term	*"Explore partnership"*; *"requires partnership"*
	EN	Extended network: Collaborating with multiple companies	*"enable [division] to lever its external networks of researchers"*
	IEN	Integrated extended network: with an associated level of integration	*"lever knowledge by implementing data standards and an integrated [external] landscape"*
Enabling Technologies	DMS	Data mining and search such as online document search	*"Advanced search capability tools with wide data sources"*
	SM	Simulation and modeling (for time based	*"Enhanced Modeling & Simulation*

		execution events)	*requiring computing power, resources ….”*
	VRP	Virtual and rapid prototyping (such as materials analysis)	*“Ease [external] coordination … by building rapid prototypes”*
	UT	User toolkits: Allowing users to interact with design or virtual models	*“Direct, two-way, consumer/professional insights obtained via….early stage prototypes...allowing [consumer] customization activities”*
Open codes	VC	Use of tools to create virtual community (blogs, forum, wiki, etc...)	*“enhance collaboration features (wiki, blogs)”; “Real-time and virtual tools”...*
	IM	Use of tools market based innovation or idea clearing tools	*“use of open collaboration market platforms …. Innocentive and other sites”*
	CA	Capability building (to profit from open innovation): by learning from exploitation and feeding back into best practice groups for application to other areas of the firm	*“the capability [collaboration know-how] can be centralized and leveraged for benefit”* *“Similar capabilities could be used to simulate”* *“Leverage success from capabilities…”* *“Integration…may require new capabilities”*
	IDC	Information dissemination capability: developing capacity to systematically disseminate and share internal knowledge or information with communities outside the firm	*“highly fragmented data sources, with over 300 home-grown formats…making it difficult to collaborate with partners”* *“[by addressing] inefficient knowledge sharing so that [external] scientists can more easily ask relevant questions”*

Annex 6.2: Decision criteria in the strategy making process

Code group	Code	Description	Examples	Presence
Strategy formulation steps	W	Want: Identifying external resources to meet its strategic intent	*"Explore partnership(s) with [names] health networks... in order to gain knowledge identifying prevalence and causality of disease, yielding potential directions for discovery of treatments and prevention"* *"to fully capture the value from external data...[followed by list of 6 specific data sources where access is sought]"*	6 (100%)
	F	Find: mechanisms used to find these external resources	*n/a*	0 (0%)
	G	Get: resources used to plan, structure and negotiate an agreement	*"defining a Partnership deal structure is a challenge"* *"requires purchase of data and/or new relationships with, and ROI may not be clear"*	6 (100%)
	M	Manager: tools, metrics and mgt. techniques for value capture	*"determine manner to keep collaborators more active in communities"* *"More incentives may be important to drive behavior"*	6 (100%)
Technology evaluation	UI	Customer utility: How useful with the technology be to end customers?	*"more compelling product/value proposition for the customer"* *"Similar capabilities could be used to simulate and assess [therapeutic area] trials (which payors are pushing for)"*	1 (17%)
	U	Uniqueness: versus competitor offerings	*"need to determine competitor advantages"* *"Improve understanding of competing products"*	1 (17%)
	MS	Market size: of eventual opportunity	*"Improve discovery process with greater data from high potential patient groups ... [allowing] patient needs and targeted diseases to be identified"*	1 (17%)
	C	Cost: of capturing opportunity	Cost estimations detailed in all cases, though vague	6 (100%)
	IP	Intellectual property: issues, benefits and risk?	*"risk of unmanaged IP protection for..."* *"need to refine policy issues on internal/external data sharing"* *"careful selection criteria for sharing"* *"unmanaged IP protection for open innovation platform[s]"*	5 (83%)
	CF	Fit: w/ company's activities	*"Future alignment with [division] and [area] to be assessed"*	1 (17%)
Open codes	TK	Seeking Access to	*"provide access to ... external data resources"* –	5 (83%)

		transferable information such as clinical data	all resources listed by name	
	SK	Access to sticky knowledge not transferable or held in networks	*"Enhance sharing of user-created knowledge through expansion of the existing…"* *"taps into the aggregate knowledge base of scientists"* *"Eases coordination between [number] active external collaborators…benefit of sharing tacit knowledge"*	5 (83%)
	LE	Learning exercise Key benefit is executed as a learning exercise	*"pilot with [named] network and refine objectives"* *" learn about use, benefit, and risks … of newly available [collaboration] techniques"* *"Very early thinking by [division] at this time….[we are] moving forward on a case-by-case basis…to explore integrating the insights and capabilities emerging"*	5 (83%)

Annex 6.3: Conceptualizations of absorptive capacity in literature

List of papers, ranked by ISI citations as of June 2008, with absorptive capacity in the title.

Authors	ISI Citations	Main Emphasis
Cohen & Levinthal (1990)	1985	Defines absorptive capacity as : "The ability to value assimilate and apply information towards commercial ends"; emphasis on exploiting externally generated knowledge
Lane & Lubatkin (1998)	295	Defines relative absorptive capacity based on Cohen & Levinthal's (1990) construct; emphasis on the learning or capability nature of the construct and its promotion by similar characteristics between partners
Zahra and George (2002)	218	Defines a set of strategic organizational processes by which firms acquire, assimilate transform and exploit knowledge for the purpose of value creation; emphasis on potential and realized, and on externally generated knowledge
Tsai (2001)	103	Examines Cohen & Levinthal's (1990) construct with an emphasis on its interplay with network centrality
Lane, Salk & Lyles (2001)	94	Examines Cohen & Levinthal's (1990) construct with an emphasis on learning in international joint ventures and exploiting externally generated knowledge
Cockburn & Henderson (1998)	91	Examines Cohen & Levinthal's (1990) construct with an emphasis on connectedness to the academic community; As such, some emphasis on pushing knowledge outside by no re-conceptualization of absorptive capacity is made: *The notion of pushing information to the outside world is implicit in the notion of "connectedness"*
Van den Bosch et al. (1999)	52	Extends Cohen & Levinthal's (1990) construct through notions of organization forms and combinative capabilities.
Minbaeva et al. (2003)	32	Examines Lane and Lubatkin (1998) construct looking into knowledge transfer to subsidiaries as a function of ability and motivation
Malhotra et al. (2005)	24	Examines Zahra and George's (2002) construct in the context of supply chain partnerships and the impact of information systems: *directly addresses externally directed information sharing system capabilities - "between supply chain partners can lead to new knowledge creation in supply chains, even when learning from partners may not be an explicit goal"- but do not use this insight to re-examine the ACAP conceptualization*
Jansen et al. (2005)	17	Examine Zahra and George's (2002) construct through coordination capabilities (i.e. cross-functional interfaces, participation in decision-making, and job rotation) and organizational mechanisms associated with socialization capabilities (i.e. connectedness and socialization tactics)
Lenox & King (2003)	14	Examines Cohen & Levinthal's (1990) construct with an emphasis on promoting it through internal knowledge provisions
Lane & Koka (2006)	11	Reviews 268 papers examining absorptive capacity, with emphasis on issues resulting from its reification
Liao et al. (2003)	11	Examines Cohen & Levinthal's (1990) construct with an emphasis intra-firm knowledge dissemination; emphasis is exploiting external knowledge internally
Nieto & Quevedo,	7	Examines Cohen & Levinthal's (1990) construct with an emphasis qualitative

(2005)		factors affecting the absorptive capacity within the organization
Grunfeld (2003)	6	Suggests that absorptive capacity effects of a firm's own R&D do not necessarily drive up the incentive to invest in R&D
Chen (2004)	4	Examines alliances effectiveness and knowledge transfer along knowledge types: finding that equity-based alliance will transfer tacit knowledge more effectively, while contract-base alliance is more effective for the transfer of explicit knowledge
Newey & Shulman (2004)	1	Introduces systematic absorptive capacity – the notion of the use of absorptive capacity to link changing lead innovators in a small system to explain performance differences: *The notion of pushing information to the outside world is implicit in notion of building systematic absorptive capacity*