AN INTEGRATED FRAMEWORK TO CLASSIFY HEALTHCARE VIRTUAL COMMUNITIES

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Abstract ▪

Healthcare (HC) strives to improve service quality through its cost-effective social computing strategy. However, sudden rise in the count of virtual community of practices (VCoPs) introduced many choices for physicians; As a result, it is not surprising to observe current literature reporting lack of study to investigate ideas integration within and between VCoPs. VCoPs need to be categorized for HC physicians so they will be able to pin-point effective a VC to attain assistance from. This paper is one of the first investigative studies, in HC sector, that proposed a framework to classify and pin-point appropriate VCoPs, for physicians, after it reviewed and analyzed traditional and up-to-date theoretical, empirical and case study literature in the area of social computing, knowledge management (KM) and VCoPs. The implementation of this framework pinpointed professional VCoPs as most appropriate for physicians based on strict requirements, i.e. closed physician communities holding many participants, which are older than 5 years with high boundary crossing. This framework is also a "one-size-fit-all" formula to build an organizational VCoP, utilizable by other business sectors.

Keywords: Virtual Community of Practice, Honeycomb, Social Media, Healthcare Knowledge Sharing, Social Networking, Social Media Platform.

Paper type – Literature review

1   INTRODUCTION:

Healthcare (HC), worldwide, aims to improve its service quality, while under economical constraints. HC suffers due to poor medical DM caused by poor diagnostic error. Previous initiatives, like electronic health record (EHR), fell short as this particular initiative was expensive and failed to reduce medical errors (Jalal-Karim & Balachandran, 2008). For an effective delivery of HC service, its aim shifted to a management strategy, i.e. HC virtual

community of practices (VCoPs) (Ranmuthugala, Plumb, Cunningham, Georgiou, Westbrook & Braithwaite 2011) on a Web 2.0 social media platform for sustaining users' generated content, a successor to Web 1.0, when content was simply published online (Kaplan & Haenlein, 2010). In HC, Web 2.0 is referred as Medicine 2.0 or Health 2.0. In this scenario, experience is collaboratively shared by using social network applications (Stewart & Abid, 2011) e.g. Wikipedia or YouTube (YT) (Kaplan & Haenlein, 2010). Such applications allow discussions and recommendation on clinical cases when HC practitioners share, validate, fuse and transform knowledge into practice within virtual communities (VCs) (Stewart & Abid, 2011). In HC, such a VCoP is a knowledge-based structure, i.e. a knowledge management (KM) tool to improve knowledge and practice (Ranmuthugala et al, 2011). For example, the analyses of plastic surgeons' VCoP - plastic_surgery@yahoogroups.com, whose one year discussions, confirmed participants were satisfied as members of such a HC VC (Foong & McGrouther, 2010). VCoP has become a high priority for many decision makers (Kaplan & Haenlein, 2010) due to its ability to facilitate HC performance (Lai, 28-30 June 2010).

Even though social media lowered the communication gap, there is no common ground to integrate ideas within and between VCs (Faraj, Jarvenpaa, & Majchrzak, 2011). VCoPs have gained value, in HC (Foong & McGrouther, 2010), even though this sector has been slow at adapting social media. On one hand, just 965 of 5,800 US hospitals use social media (Stewart & Abid, 2011). On the other hand, in 2009 alone, 175 million users visited Facebook (Fb) (Kaplan & Haenlein, 2010). In addition, hospitals that adapted social media created 777 Fb pages, 120 blogs and 486 YT accounts (Stewart & Abid, 2011). With, such a sudden rise in the count of HC VCoPs, it is no surprise, HC quality suffers from information overload flooding information systems (ISs) (Bate & Robert, 2002). Additional mechanisms need to manage tacit knowledge within VCoPs, since a VCoP has not always been an appropriate KM tool (Roberts, 2006). This view has reflected the need for attention on research that lacks to investigate how ideas are integrated within and between a VCoP (Faraj et al, 2011). The thought of integration of ideas across VCoP was also discussed in another study, where team-based organizations setup VCoP for participants from different teams to share knowledge. In this scenario, decision support systems (DSSs) were utilized to transform ideas into policies for future DM (McDermott, 1999). This is a view, not only of this study but a recommendation by another study. The classification of VCoPs is highly necessary for their successful application, in different business sectors (Roberts, 2006).

This study reviewed and investigated current literature, in search of an appropriate framework to classify VCoPs, so HC professional could access the right VCoP platform on the right social media platform. This would solve the problem of daily popping up VCoP adding to the current dilemma of information overload (Bates & Robert, 2002). As suggested, also by another study, CoP effectiveness/impact on HC practice is still another lacking research area due to no reported evidence of any quantitative study from 1991 to 2005, a to show, why and when a CoP facilitates improvements in HC performance (Ranmuthugala et al., 2011). Now that the research topic and its challenges have been introduced, following are abbreviations that are revised and defined for further clarification.

- HC: Healthcare - the research context. HC utilizes Health Informatics to support HC services (Keselman, Logan, Smith, Leroy, & Zeng-Treitle, 2008)
- IT: Information Technology is utilized by HC (Chiasson, Reddy, Kaplan, & Davidson, 2007), e.g. social network (Ryu, Ho, & Han, 2003)
- VC: Virtual Community – social network of individual interactions focused on social bonding like in Fb or individual creativity like in YT (Faraj et al, 2011)

- CoP: Community of Practice - where a group of participants share concerns, passion of a topic or problems and experience, through interactions (Dubé, Bourhis, & Jacob, 2006)
- VCoP: Virtual Community of Practice – similar concept of CoP but an Internet-based community (Powell, Englesakis, & Rizo, 2004)
- KM – Knowledge Management – is a business administrative concept applicable in HC, to create, share and apply knowledge to facilitate diagnoses (Riano, 2010).

This study is laid out as follows:
- Section 2 of this study reviewed literatures to describe the research area and expressed lack in research, research problem and the importance to classify and pinpoint VCoPs for physicians. This was followed by defining and explaining social media and VCoPs functionality, based on two appropriate frameworks (honeycomb framework to define social media and 21 structural characteristics framework to define VCoPs
- Section 3 descried the methodology of this study
- Section 4 justified the customization of the two frameworks for this research context
- Section 5 described how the customized frameworks were integrated and then implemented to classify and identify most appropriate social media platform and most appropriate VCoP/s
- Section 6 discussed and concluded this study's findings, based on their justified correct co-occurrence with literate-backed theory. This study also stressed on the relevance of its findings to the needs expressed by current literature.

2   LITERATURE REVIEW:

Even though all terms used by this paper, were abbreviated in the previous section, social media, social networking, VC, CoP and VCoP need further clarification that should be facilitated by reviewed literature, so they will be compared for their similarities and differences. Such clarification is mandatory as per the view of this study.

2.1   Defining Social Media, Social Networking, Virtual Community of Practice and Knowledge Management:

Social media has become top priority for many businesses, where decision makers and consultants seeking means to increase organizational profits through social networking applications. Social media as a term needs clarification (Kaplan & Haenlein, 2010). While, some VCs focus on social bonding, like Fb, others focus on individual creativity, like YT or InnoCentive. Within a VC, knowledge collaboration occurs when knowledge is shared and modified as well as new knowledge is created and integrated. Same as when physicians collaborate during problem solving within a VCoP (Faraj et al, 2011). In 2009, Fb (a social network application for social networking) reported 175 million users. Similarly, YT reported 10 hours of video uploading per minute while, Flickr reported that it hosted 3 billion images. In addition, 75% of Internet surfers visited social media in the second quarter of 2008 through social networking sites and blogs. These surfers were not only teenagers but also 35-44. Social media is a revolutionary trend that raised interest in commercial organizations. The concept of social media began in 1979, from Usenet, a discussion system for posting public messages. This led to a term "*weblog*", which later transformed to "*blog*". In 2003, high speed Internet introduced MySpace. In 2004, Fb was introduced later. Hence, an officially term took birth as social media (Kaplan & Haenlein, 2010). In the past, Internet was used to read, as its content was used to buy product/service. In this era, social media platform utilized to create and share content capable of

affecting an organization's reputation, sales and survival (Kietzmann, Hermkens, McCarthy, & Silvestre, 2011). The emergence of social networking applications, like Fb and Ln, opened new doors for discussions within VCs (Konito, 2011).

Communities are sources of knowledge and hold members who are dispersed, unknown and unidentifiable (Faraj et al, 2011). VCs, such as, CoP, are Internet-based social bodies where a group of participants passionately share common concerns (Robertson, 2011) and knowledge to solve problems, explore ideas about a topic Ranmuthugala et al., 2011). Hence, these participants develop personal relationship while gaining deeper knowledge and expertise, within a supportive environment during constant interactions (Robertson, 2011). A CoP, an old phenomenon (manhattan Research A Decision Resource Group Company, 2012), was first identified in the learning theory, even though widely used in social science theories. Here, participants learn by sharing concerns. Even though, this is an old phenomenon (e.g. a neighborhood is a community, not a CoP), this concept is applied within organizations. Hence, this concept is new (Wenger, 2006) as it shares similar participative innovative behaviors. Hence, current organizations play a major role in fostering VCoPs to gain performance leverage (Dubé et al, 2006). Three characteristics form a CoP being:
1. Domain - identity of CoP formed through interest sharing, where participants learn from each other,
2. Community - where members participate to solve problems and
3. Practice - unlike community of interest, CoP members share practice. CoPs are driven through activities like problem-solving, information requesting, experience seeking, resources utilizing, discussing, project documenting, knowledge mapping and gap identifying (Wenger, 2006).

CoP is where a group of participants share concerns, passion of a topic or problems, to deepen their knowledge and experience, through interactions in order to be innovative (Dubé et al, 2006).Considering that, VCs have value, is the main reason why organizations invest on them, resulting in positive returns on investment. A supportive organizational environment is healthy for a VC (Robertson, 2011). In HC, a CoP is seen as knowledge-based structure i.e. a tool utilized to improve knowledge and practice (Ranmuthugala et al., 2011). Innovation is an outcome of a VCoP when tacit knowledge is shared within such a group. There are a number of differences between VCoP and a classical CoP. Features, of a VC, are reflective of its participants' feelings, identity and their belonging. Such a sense is less in the virtual scenario, than in classical face-to-face communities (Sarringhaus, 2011). VCoPs are KM tools that overcome space and time, through the application of ICT to facilitate members' virtual interaction by tools, such as email, video conference, etc. Literature has fallen back, to single dimensionally associate CoP with VCoP, even though there are differences like geographical displacement, life span along with boundary span, size and enrollment. Confusion occurred, due to common properties between CoP and VCoP. The main difference is the technological facilitation of VCoP, as resource sharing is based on trust and belonging, which is more challenging in computer-based interactions (Dubé et al, 2006). In addition, every physician of all specialties and age is increasingly shifting his/her professional activities to VCoPs, such as UpToDate or Medscape, where physicians visit VCs many times daily, weekly and/annually (manhattan Research A Decision Resource Group Company, 2012).

VCs allow physicians to brainstorm, share their insights when solving problems and discussing other cases. E.g. SERMO – a professional social network established in 2006, in Cambridge, is composed of 11,000 physician members in USA (Peskin, 2009; Zacks, 2007). Other examples are Epocrates, Medscape and QuantiaMD. QuantiaMD was established since 2005, composed of 40, 000 participants and is the most ambitious VCoP, due to its content and videos from experts.

Medscape is owned by WebMD and is made up of 100,000 members, who read discussions, post comments and begin new discussion topics, where video supported blogs show-off commentary from experts. Medscape shares 150 journals and 6,500+ discussion topics. Epocrates is made up of 200,000 members; began in 1998 and is based in California. This social network has more clinicians than any of the three previous mentioned. As reported by Epocrates's CEO, within 45 minutes, 50 experts tend to respond to any posted clinician's problem. This facilitates lowering communication and collaboration barriers through VCs. As reported by QuantiaMD's CEO, within seconds 4,800 experts answer any disease related question (Peskin, 2009). In 2008, an online and telephone survey of 1,832 US physicians, reported that 60%, younger generation of primary care female physicians and members of VCoPs, such as SERMO and MedScape Physicians, consulted online patients by using PDA devices (iHealth Beat Reporting Technology's Impact on Health Care, 2009).

2.2 Knowledge, Knowledge Sharing and Knowledge Management in Virtual Communities:

A CoP is held together by interest and shared learning where knowledge is shared through conversations based on storytelling (Puusa & Eerikäinen, 2007). Knowledge is either explicit or tacit. While explicit knowledge can be articulated, tacit knowledge resides within experts' actions and experiences (Hicks, Dattero, & Galup, 2007). Tacit knowledge is an expressible form of knowledge, unconsciously existing everywhere (Hicks, Dattero, & Galup, 2007; Hara & Hew, 2007). The abstract nature of tacit knowledge makes it very personal and difficult to visualize. Such type of knowledge expresses itself as occupational know-how and includes intuition, sensations, beliefs and feelings, which are difficult to formulate and acquire except through personal practical experience. Since tacit knowledge is deeply rooted in experience and practice, due to which the line between tacit and explicit knowledge is very vague. Tacit knowledge can be accumulated through a work community (Puusa & Eerikäinen, 2007). There is a relation between data, e.g. 140, information, e.g. patient's blood pressure being 140mmHg and knowledge (Hicks, Dattero, & Galup, 2007), e.g. a patient with blood pressure greater than 140 mmHg is going through hypertension (Riano, 2010). KM is a business administrative concept applicable in HC, to create, share and apply knowledge, to influence medical and clinical procedures like diagnoses, therapeutics and prognosis. KM is classified by: (1) know-what – declarative knowledge that answer questions, (2) know-how – procedural knowledge answering how-type questions and (3) know-why –why-type evidence-based explanatory knowledge (Riano, 2010).

2.3.   History and Growth of Community of Practice:

The theory of CoP initiated in 1991. In 1998, CoP concept refined knowledge creation and sharing between participants. In 2002, CoP was re-defined as a managerial tool to benefit an organization (Ranmuthugala et al., 2011). In 1997, a VCoP named as "*Sixdegrees*" was established and was capability of adding friends and creating friend lists. Four years later, other sites like Twitter, Fb, Hi5, Ln, etc started doing the same. After 1990s, blogs like Technorati got popular, for ranking web sites. In 2006, Twitter was established, composed of 145 million users (Kietzmann et al., 2011). By 2002, an assessment of CoP's effectiveness, confirmed that research still lacks in this area (Ranmuthugala et al., 2011). As per opinion of the authors of this paper, the development of social media and social network applications were in parallel, where one assist in supporting and defining the other. In 2011, a survey from participants of QuantiaMD, reported more than 65% of physicians use and highly regard social media's social networking applications such as Ln, Fb and professional sites. Also, few physicians were concerned that patients used such sites as the means to complain upon the medical community or spread wrong information (Modahl, Tompsett, & Moorhead, 2011).

2.4. Research Barrier in Virtual Community of Practice:

There is a common trend in literature reflecting the need to classify VCoPs. HC sector faces information overload, which hampers HC quality (Bate & Robert, 2002). HC systems are information rich but knowledge poor (Mansingh, Osei-Bryson, & Reichgelt, 2009). There is a significant rise in the growth and adaptability of VCoPs in the HC sector (Kaplan & Haenlein, 2010; Stewart & Abid, 2011) while research still lacks in the area of VCoPs (Ranmuthugala et al., 2011). There is also lack of research on ideas integration within and between VCoPs (Faraj et al, 2011). In addition, there is lack of understanding of social media considering its various forms (Kietzmann et al., 2011). When the authors of this paper performed a Google search on Fb and Ln closed and physician-only VCoPs, they came across 22 Ln VCoPs, 14 Fb VCoPs and 3 professional VCoPs. i.e. 39 VCoPs (table 3). From 2002 till now, not only is literature showing that VCoP is a new research area but needs more attention while there is a high rate of VCoPs popping up daily, even though, research lacks to investigate why ideas integrate between and across VCoPs. It is clear that such a lack of research would be present when VCoP, as a research area, is still new. In addition, it not surprising that research did not attend on ideas integration when just recently, literature introduced the honeycomb framework to define social media (Kietzmann et al., 2011) and the 21 structural characteristics framework model to develop and classify a VCoP (Dubé et al, 2006). As per authors' analyses, integration of these two frameworks can support classifying and pinpointing a VCoP. It is necessary to apply honeycomb before 21 structural characteristics framework model since a VCoP can exist in multiple media platforms. For instance, Epocrates is present as a profession VCoP, (i.e. is hosted on http://www.epocrates.com/) and as another study stated, is hosted through Fb and Twitter (iHealth Beat Reporting Technology's Impact on Health Care, 2009). By assessing a VCoP first by its media platform and then by its own definition and functionality, is one route to classify and define properties for a VCoP to reflect whether or not it qualifies as the right VCoP based on a pre-set criteria.

2.5. Honeycomb framework and 21 structural characteristics framework:

Social media has become very powerful due to its ability to share, modify and discuss user generated content between individual and communities through its highly interactive platforms. To tackle the lack of understanding of social media considering its various forms, a definition, based on honeycomb framework, composed of seven functional building blocks, to better understand the social media platform. These blocks are:

1. Identity - is users' willingness to reveal their identity within a social media tool, e.g. Fb revolves around user identities,
2. Conversation - is the extent of users' communication within social media,
3. Sharing - is the means to participate and converse, i.e. to receive, distribute and exchange resources, e.g. YT videos,
4. Presence - is when one user is aware of another user's accessibility or location, e.g. users' location on Fb,
5. Relationship - is the association between users to facilitates sharing, e.g. number of user's connections on Ln,
6. Reputation - is identification of one's own and anthers' standing in a social media to facilitate trust, e.g. likes tag on Fb and
7. Groups - is the user's ability to establish a community, e.g. closed or open (Kietzmann et al., 2011).
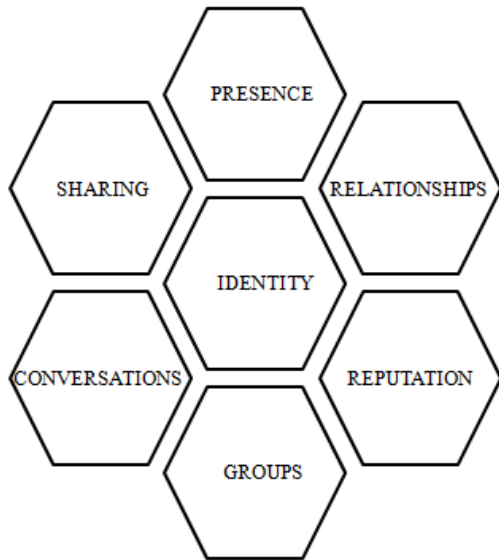
Figure 1. Framework to define the functionality of Social Media
Source: (Kietzmann et al., 2011).

Once the right social media is selected, the next step is pinpointing the appropriate VCoP. The 21 structural characteristics framework (table 1) is organized in three parts being:

1. Demographics,
2. Organizational context and
3. Member characteristics (Dubé et al, 2006).

DEMOGRAPHICS	ORGANIZATIONAL CONTEXT	MEMBER CHARACTERISTICS
Orientation -	Creation process -	Size -
VCoP created for operational or strategic organizational purpose	**Spontaneous** - if few interested participants jointly developed a CoP **Intentional** - if management selected members to perform a purpose.	**Small** - very few members. **Large** with more than 1000 members
Age -	Boundary crossing -	Geographic dispersion -
Young – CoP is <1 year. **Old** - CoP is > 5 years.	**Low** - for knowledge sharing if members are within one unit of same organization. **Medium** - If they interact across units but within the same organization. **High** - if they cross units and their organizations	**Low** - members are in same physical location, **medium** - scattered throughout a city/state or **high** - dispersed worldwide.
Life span -	Environment -	Members' selection process -
Temporary: - when VCoP is initiate for single purpose or **Permanent**| - when VCoP is for information and knowledge sharing,	CoP is shaped by its organizational environment that is either **facilitating** or **obstructive**.	**Closed membership** - for control like specific criteria or **open membership** - for anyone to join.
Level of maturity -	Organizational slack -	Members' enrolment -
Potential| - when members plan CoP development. **Coalescing** - setting CoP	CoP resources for participants to learn in order to sustain a community where is resources are **high** then CoP is more	**Voluntary** - members join if interested, **strongly encouraged**:

values, after it started. **Maturing** –members trust and creating new knowledge, **Stewardship** – to uphold CoP momentum. **Transformation** –to re-start or phase-out a CoP.	likely facilitated than when resources are low.	compulsory by management:
	Degree of institutionalized formalism -	Members' prior community experience -
	Invisible - visible to group within organization or **legitimized** - permitted, resources or **institutionalized** - integrated with the organizational structure.	**Prior experience** e.g. face-to-face and then **virtual** or **none**.
	Leadership -	Membership stability -
	Assigned during CoP initiation i.e. members take on leadership roles within CoP.	**Stable** like closed community or **fluid** like an open community.

Table 1.   21 Structural Characteristics Framework for VCoP development
Source: (Dubé et al, 2006).

As a result, this section:
- Justified how social media is becoming top priority where clarification is needed in terms described in this section,
- Statistically highlighted the impact of [public on social computing and establishment of social media platforms and VCs,
- Defined CoP, VCoP and KM as well as defined KM and its processes,
- Portrayed the history behind CoP and justified the need to classify VCoPs in the HC sector and
- Introduced two frameworks (honeycomb and 21 structural characteristics framework) that begin to define social media and VCoPs in order to facilitate classifying them.

3.   METHODOLOGY

This study is deductive research. It began by understands the broad HC landscape (research context). Once this study understood that HC quality suffers due to diagnostic errors, it embarked on reviewing literature on past strategies, which led this study to disembark on its current and promising social networking strategy, in line with Web 2.0. At this stage, this research examined social computing and VCoP literature in parallel with KM literature, since VCoPs are KM tools and both are applicable in facilitating HC quality. Existing research, i.e. peer-reviewed and reputed journals (chief norm resources for this study) was then structured under the objective to analyze how integration of ideas can be facilitated between and across VCs; by first classifying VCoPs and the social media platforms they are hosted upon. This study also reviewed other literatures from sectors other than HC that adapted social media and VCoPs to search for an appropriate framework to classify and pinpoint VCoP/s. As a result, this study embarked upon the honeycomb framework and 21 structural characteristics frameworks. These frameworks were then customized to fit this study's context. Next, 39 VCoPs (table 4 - appendix) were evaluated based on these newly customized and integrated frameworks. Only closed and physician-only VCs, from Fb, Ln and professional VCs, were selected and hence were part of the list of 39 VCs.

4.   FRAMEWORK DEVELOPMENT & PROPOSED SOLUTION:

This section examined and justified the two frameworks, so each can be customized as per this paper's scope (HC sector and context (old VCoPs composed of only physicians from various specialities and hospitals closed community) of this study.

4.1 Evaluating and justifying the selection of a Social Media:

Considering that, there are dozens popping up social media applications, it would be best to purse the right social medium (Kaplan & Haenlein, 2010). One example is SERMO (Sermo Inc, 2012). Certain social media platforms attract certain groups, such as book lovers prefer joining content community related social media. To target the right population; one should target its utilized social media (Kaplan & Haenlein, 2010). Kietzmann et al. (2011)'s honeycomb framework justified Fb, YT, Ln and Foursquare social media platforms. Fb, Ln and YT are important HC social media platforms since HC experts utilize Fb, Ln, etc for networking purposes. Such social media platforms are re-shaping HC (Hawn, 2009) and 65% of physicians use and highly regard Ln, Fb and professional VCoPs (Modahl, et al, 2011). Based on these arguments, this study's opinion is that the honeycomb framework falls short since it does not define HC professional VCs. Hence, despite the fact that there exists Ln, YT or Fb, professionals still join communities, defined by commonly shared focus, learning, collaboration and values, where experiences are shared for professional development and performance feedback (Louis, Marks, & Kruse, 1996). As per the analyses of the authors of this study, when the honeycomb framework is compared with the social capital theory (SCT) that describes VCoP members' participation, it is clear that various building blocks of the framework are quite inter-related to each other. This study defined professional VCs by introducing a more collaborative balance of honeycomb functional blocks (figure 2. The darker shade defined a higher rate in functionality than the lighter shade with irrespective functionality within blocks that hold no shade. All blocks do not need to be present within a social media activity. The honeycomb framework of professional VCs (figure 2) differs from the honeycomb frameworks that represented Fb and Ln (figure 1) (Kietzmann et al., 2011).
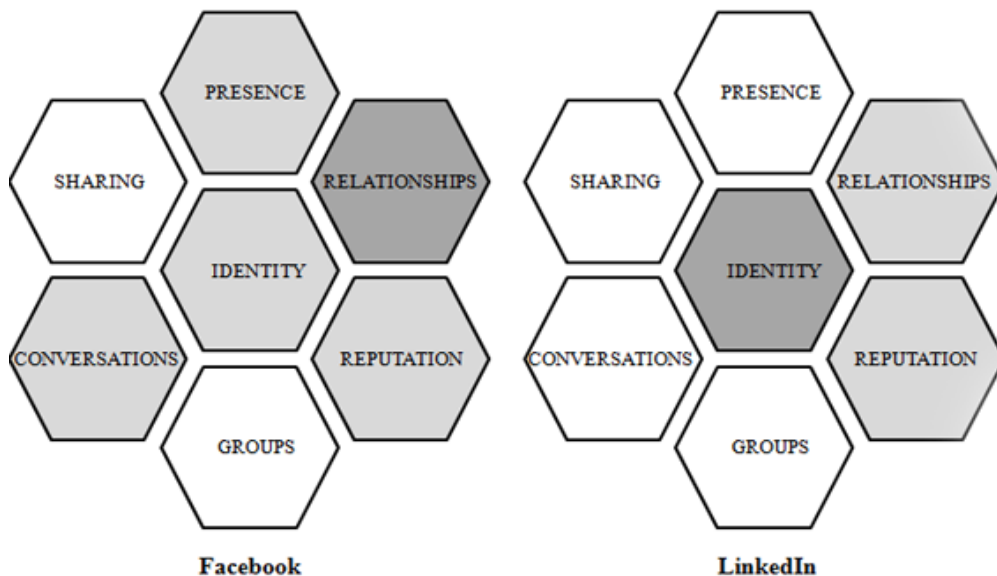

Figure 2.   Contracted functionalities of Fb and Ln
Source: (Kietzmann et al., 2011).

This study customized the elements of the honeycomb framework to define professional VCs (figure 3). The SCT explains social participation in social networks that support knowledge sharing (Chang & Chuang, 2011). SCT can justify the inter-relations between various elements that form the foundation defining professional VCs. Therefore, as per the perspective of SCT, selected elements that define professional VCs are identity, sharing, relationships, groups, reputation and conversation. Knowledge sharing occurs within a CoP (Rantapuska & Ihanainen, 2008) when the group is making decisions, while members know, who is good at what. This brings awareness of and trust upon each other's expertise. Members, also become aware of each other's identity because they trust each other (Austin, 2003) since reputation builds trust among group members (Chiu, Hsu, & Wang, 2006). In this case, such relationships are key commodities for accomplishing effective work through collaboration, where successful cost-effective resource sharing is possible through knowing-who knows-what and knowing-how (Oinas-Kukkonen, Lyytinen, & Yoo, 2010). Mutual interests or experience can also be shared by group members. In addition, participants' involvement within a VC is directly proportional to their benefits from the community, where frequents community visits lead to higher conversations/discussions (Chang & Chuang, 2011). On the other hand, presence - knowing where other members are (Kietzmann et al., 2011). VCs are not dependent on face-to-face interactions since members interact through communication systems (Chang & Chuang, 2011). Hence, co-presence of members is irrelevant to a sense of a VC, since physical context becomes irrelevant (Sicilia & Palazôn, 2008). Henceforth, while presence is irrelevant, all other honeycomb framework elements are important with conversation most important, for defining a social media platform contribution of ideas, Conversation is most important since utilizing rich forms of communication, facilitate tacit knowledge transfer, most important through personal conversation, to encourage immediate feedback, where various means of communications, such as personal skills, are utilized (Antonio & Lemos, 2009). This argument is agreeable by this study, since conversations lead to participants' interaction (Faraj et al, 2011).
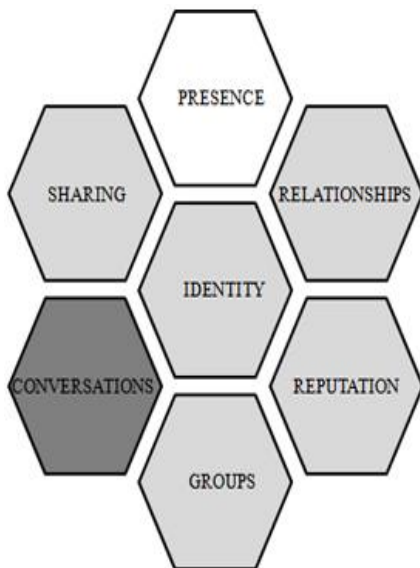

Figure 3.   Contracted functionalities of professional HC VCoPs (new contribution of this paper)

4.2   Evaluating and justifying the selection of a Social Network application, i.e. a (VCoP):

Next, each of the 21 elements, of the 21 structural characteristics framework, is assessed. Table 2 portrays the chosen values for each element, from all possible values, (table 1) to pinpoint appropriate VCoP. Various characteristics are not applicable as per scope and context of this study being: orientation, leadership, members' prior community experience, membership stability, members' ICT literacy, cultural diversity, topic's relevance to members, degree of reliance on ICT and ICT availability. Orientation, leadership, organizational slack members' enrolment, cultural diversity and members; prior community experience, membership stability are also out of the context of this study. Topic's relevance to members, degree of reliance on ICT and ICT availability are also not relevant to this research since this study does not concerned on VC's topic and the relevance or availability of ICT. Environment was also deserted since this study does not want to constrict itself to only organizational VCoPs. Same goes for Degree of institutionalized formalism, since resource tracking is also not part of the context of this paper. In addition, geographical dispersion is also irrelevant, since in a VC geographical distances diminish. Life span and level of maturity are also irrelevant.

This research assesses selection of a VCoP based on the four remaining characteristics to form an enhanced 4 characteristics structural framework (table 2). Four reasons support the acceptance of these four characteristics (table 2).
1. Age - older VCoP carry higher repute than young VCoPs.
2. Size - large VCoPs support more conversations than small VCoPs.
3. Members' selection process - closed VCoP is better than an open community/group to assure only physicians are members and not any other HC stakeholder like patients, nurses, etc.
4. High boundary crossing - is when each one of the VCoP members, works for different employees but low refers to VCoP members working for a single employee (Dubé et al, 2006).

High is better than low boundary crossing, since idea behind working for multiple employees was interpreted as physicians coming from different specialities or hospitals. Since this study, only considered VCoPs for knowledge sharing and physicians' problem solving, it would be best to consider high boundary crossing.

21 Structural Characteristics	Selected Criteria	Not applicable
Orientation		√
Life Span		√
Age	Old	
Level of maturity		√
Creation process		√
Boundary crossing	High	
Environment		√
Organizational slack		√
Degree of institutionalization formalism		√
Leadership		√
Size	Large	
Geographic dispersion		√
Members' selection process	Closed Group	
Members' enrolment		√
Members' prior community experience		√
Membership stability		√

Members' ICT literacy		√
Cultural diversity		√
Topic's relevance to members		√
Degree of reliance on ICT		√
ICT availability		√

Table 2.   Modified 4 Characteristic Structural Framework– Selected and Ignored elements to pinpoint a VCoP

Main points summarizing this section are:
- Described the honeycomb framework for defining and justifying the classification of social media platform through its 7 functional elements (searching, presence, identification, relationships, reputation, conversation and groups).
- Customization of honeycomb framework to define professional VCoPs - new contribution of this paper.
- Customisations of 21 structural characteristics framework that was enhanced for 4 structural characteristics framework since this framework was adjusted also to fit the context of this research.

5   FRAMEWORK CUSTOMIZATION AND IMPLEMENTATION AND RESULTS:

The proposed framework of this study is a sequential customized, integrated and then sequentially implemented through six steps:
1. First, the honeycomb framework was customizing to define a professional VC social media platform (figure 2). As a result professional VCs also have a defined honeycomb framework along with Fb and Ln.
2. Second, the 21 structural characteristics framework (table 1) was customized to fit the context of this study. As a result, the 21 structural characteristics framework was shrunk down to a4 structural characteristics framework (table 2).
3. Third, both of these customized frameworks were sequentially integrated by first implementing the honeycomb framework. Hence, as per the honeycomb framework implementation, VCoPs from three platforms (Fb, Ln and professional VCs) were selected as appropriate VCs to be assessed by the 4 structural characteristics framework.
4. Fourth, year of birth and members' count were noted down, for each of the 39 VCoPs (table 3); so all VCs would be assessed by the 4 structural characteristics framework.
5. Fifth, each VCoP, of 39 VCs, was evaluated based on the 4 structural characteristics (1) age, (2) boundary crossing, (3) size and (4) members' selection process. A check mark (√) meant that the respective requirement, of the four requirements, was met by the VC being assessed. A cross (×) meant that requirement was not met.
6. Sixth, results of the 39 VCoPs (table 3) were analyzed and hence distinguished into three classifications as topology A, topology B and topology C where only topology C VCs fulfilled all 4 requirements, i.e. professional VCoPs on a professional VC social media platform. Topology B VCs fulfilled only 3 of 4 requirements while topology A VCs only fulfilled 2 or 4 requirements.

1=Age, 2= Boundary crossing, 3 = Size, 4 = Members' selection	Topology

No.	VCoP Name	Year of Birth	Members' count	process						
				1	2	3	4	A	B	C
LinkedIn										
1.	National Association of Physician Advisors	2009	254	×	√	×	√	√		
2.	The Physician Network	2010	722	×	√	×	√	√		
3.	Global Physician Network	2008	121	×	√	×	√	√		
4.	Group to connect Physician all over world	2007	57	×	√	×	√	√		
5.	The Physician Network	2010	`722	×	√	×	√	√		
6.	American Doctors	2010	882	×	√	×	√	√		
7.	The Medical Informatics Physician	2008	1,014	×	√	√	√	√		
8.	UK Doctors	2010	749	×	√	×	√	√		
9.	Middle East Doctors	2010	624	×	√	×	√	√		
10.	Medical Doctor (MD) Network	2008	8, 161	×	√	√	√	√		
11.	American College of 1Physicians	2008	2,285	×	√	√	√		√	
12.	American Board of Physician Specialists (ABPS)	2009	99	×	√	×	√	√		
13.	Astute Physician	2009	35	×	√	×	√	√		
14.	Chinese Doctors	2010	51	×	√	×	√	√		
15.	Global Surgeons and Physician Professional Network	2009	48	×	√	×	√	√		
16.	MDSNe - Medical Doctors Social Networking	2010	36	×	√	×	√	√		
17.	If you are. Canadian Physician wanting a chance in city. Contact me	2010	23	×	√	×	√	√		
18.	MCMS Physician Members	2009	10	×	√	×	√	√		
19.	Northshore University Healthsystem Physician Group	2011	11	×	√	×	√	√		
20.	New England Physician Network	2010	14	×	√	×	√	√		
21.	American Association of Physician Specialists	2008	31	×	√	×	√	√		
22.	Physician Alignment, integration and Operations	2011	29	×	√	×	√	√		
Facebook										
1.	Thai Physicians	No date (nd)	×	√	√	√		√		
2.	Naturopathic Physicians	nd	519	×	√	×	√	√		
3.	APPNA Young Physicians	nd	638	×	√	×	√	√		
4.	Thai American Physicians	nd	318	×	√	×	√	√		

	Foundation									
5.	PIT Physicians Support Group	nd	308	×	√	×	√	√		
6.	Physician_pharmacist club	nd	305	×	√	×	√	√		
7.	Arcadia Physician Assistant Rotations	nd	256	×	√	×	√	√		
8.	USMLE for Thai Physicians	nd	543	×	√	×	√	√		
9.	New York State Society of Physician Assistants	nd	507	×	√	×	√	√		
10.	Residency Ready Physicians	nd	327	×	√	×	√	√		
11.	Columbia College of Physicians and Surgeons Class of 2015	nd	242	×	√	×	√	√		
12.	Physicians + Facebook Marketing - How to do it correctly!	nd	173	×	√	×	√	√		
13.	SUNY Downstate Physician Assistant Alumni Group	nd	140	×	√	×	√	√		
14.	Egyptian Women Physicians and Scientists	nd	176	×	√	×	√	√		
Professional VCoPs										
1.	SERMO	2006	100,000	√	√	√	√			√
2.	QuantiaMD	2005	40,000	√	√	√	√			√
3.	Epocrates	1998	200,000	√	√	√	√			√

Table 3.   Integrated Framework Implementation results – Case of on LinkedIn, Facebook & Professional HC VCoPs

Based on the above, the main points summarizing this section are:

- This study sequentially integrated the two frameworks. First the honeycomb framework was implemented followed by the 4 structural characteristics frameworks. Implementation of each framework was by assessing each of the 39 VCoP (table 4 in appendix) against the requirements of the two frameworks.
- As a result each VCoP was classified under three topologies (A, B and C) with only professional VCoPs able to fulfill all requirements. Hence, only y professional VCoPs were classified part of topology C.

6   DISCUSSION AND CONCLUSION:

Based on the observation of results in table 3, all 39 VCoPs are closed physician groups. All Ln VCoPs were only professional, networking or corporate type of groups. All VCoPs showed high boundary crossing, i.e. a VCoP should not be corporate but a professional or networking type. Only three professional VCoPs qualified as high boundary crossing groups. Any corporate VCoP was unchecked. No Ln or Fb VCoP qualified met the age requirement, (i.e. no VC was older than 5 years). Three of these VCoP qualified for boundary crossing, size and members' selection process (i.e. The Medical Informatics Physician, Medical Doctor (MD) as well as Network and American College of Physicians). As depicted in table 3, none of Fb's VCoPs qualified when assessed under similar conditions VCoPs of Ln. Fb did not publish any year of birth for any of their VCoPs (table 3). Hence, these VCoPs were left unchecked when assessed against age criteria. Even if this age factor was assessed, none of the Fb VCoPs would be acceptable. Even

with the exclusion of age factor, only one VCoP (i.e. Thai Physicians) could comply against 3 other factors: boundary crossing, size and Members' selection process. When the 3 professional VCoPs were assessed, al complied against all 4 elements of the enhanced 4 structural characteristics framework. In conclusion, all results were classified 38 VCoPs into 3 typologies: being A, B and C. Typology A VCoPs were those that only established boundary crossing and had a sufficient member selection process, i.e. closed group. Typology B were those VCoP that qualified for all but were young VCoPs. Typology C was professional VCoPs that qualified for all criteria being age, boundary crossing and size as well as member selection process, (table 3). All VCs evaluated in table 3 have their source listed in table 4 in the appendix of this paper.

If VCoP (i.e. KM tools) can facilitate DM through knowledge sharing, then it is sharing of knowledge that this study integrated as idea integration. When idea integration occurs within a VCoP, this can also be interpreted as utilization of communication technologies to facilitate organizations to support teams to virtually communicate (Alge, Wiethoff, & Kleinc, 2003). If idea integration occurs across VCoPs; this can be associated with collaboration of projects performed on social media platforms e.g. jointly adding or editing text on Wiki (Kaplan & Haenlein, 2010) or even knowledge collaboration through its sharing, transferring, accumulating, transforming and co-creating when one offers knowledge to another so it can be re-combined or integrated to sustain a VC (Faraj et al, 2011). Since there are ample VCoPs popping up daily (Kaplan & Haenlein, 2010), idea integrated can be facilitated through a framework that can classify VCoPs and assists professionals in pin-pointing most effective VC and VCoPs, as per their requirements similar to honeycomb and 21 structural characteristics frameworks. Such a integrated frameworks shed deeper understanding for future research to get further encouragement in integrating ideas integration especially with the up and coming Web 3.0 advanced search capabilities in the world of semantic web.

The framework proposed by this study, was an integration of two frameworks that were initially customized to fit the scope of this research. The integrated framework was then implemented. After implementation, results conclude that Fb and Ln are not enough as social media platforms, using which one can select a VCoP. Henceforth, it was wise to look into professional VCoPs; 39 VCoPs were assessed based on the proposed integrated frameworks. Upon integrating honeycomb and 21 structural characteristics frameworks, this study was able to establish a solution framework to pinpoint to an appropriate VCoP based on the right social media platform. Future research can: utilize this framework not only in the HC but other business sectors. However limitations of this research should be taken under consideration when reflecting this framework in other studies. First, when VCoP were selected following factors were taken under consideration;
1. HC was the business sector,
2. Closed groups were the only consideration,
3. Physicians were the only accepted peers for participants in a community and
4. All CoPs needed to have a high count of participants to be part of the list of selection. This framework can be also utilized to categorize VCoPs.

No research has classified VCoPs, an important contribution since there are many VCoPs being developed. Similar discussions could take place in ample VCs and information and knowledge. We are in an era where one study reports that a mobile device will be the primary Internet connecting mechanism (Kaplan & Haenlein, 2010). With the advent of Web 3.0's collaborative movement moving towards semantic web, such a framework is only the initial step towards facilitating future initiatives to facilitate more advanced search capabilities.

As a result, this study was able to achieve and contribute the following:

- Introduced honeycomb framework (figure 1) that was later customized for professional VCoPs (figure 3) as well as introduction of the 21 structural characteristics framework (table 1) followed by its customization for the context of this research (table 2).
- Sequential integration of the two frameworks (table 3) was followed by implementation of these two frameworks on 39 VCoP (table 4 in appendix).
- As a result, 39 VCoPs were classified in three topologies (A, B and C) (table 3).

References

Alge, B. J., Wiethoff, C. and Kleinc, H. J. (2003). 'When does the medium matter? Knowledge-building experiences and opportunities in decision-making team'. Organizational Behavior and Human Decision Processes, 91: 26–37.

Antonio, L and Lemos, B. (2009). 'Relevant factors for tacit knowledge transfer within organisations'. Journal of Knowledge Management, 14(3): 26–37.

Austin, J. R. (2003). 'Transactive Memory in Organizational Groups: The Effects of Content, Consensus, Specialization, and Accuracy on Group Performance. Journal of Applied Psychology', 88(5): 866–878.

Bate, S and Robert, G. (2002). 'Knowledge Management and Communities of Practice in the Private: Lessons for Modernizing the National Health Service England and Wales'. Public Adminis- tration, 80(4): 643–663.

Bhattacharya, C. B and Sen, S. (2003). 'Consumer-Company Identification: A Framework for Understanding Consumers' Relationships with Companies'. Journal of Marketing, 67: 76-88.

Chang, H. H and Chuang, S.-S. (2011). 'Social capital and individual motivations on knowledge sharing: Participant involvement as a moderator'. Information & Management, 48(1): 9-18.

Chiasson, M., Reddy, M., Kaplan, B and Davidson, E. (2007). 'Expanding multi-disciplinary approaches to healthcare information technologies: What does information systems offer medical informatics?'. Journal of the American Medical Informatics Association, 76(1): 589-597.

Chiu, C.-M., Hsu, M.-H and Wang, E. T. (2006). 'Understanding knowledge sharing in virtual communities: An integration of social capital and social cognitive theories'. Decision Support Systems, 42: 1872–1888.

Dubé, L., Bourhis, A and Jacob, R. (2006). 'Towards a Typology of Virtual Communities of Practice'. Interdisciplinary Journal of Information, Knowledge, and Management, 1: 69-93.

Easton, A. C., Vogel, D. R and Nunamaker, J. F. (1992). 'Interactive versus stand-alone group decision support systems for stakeholder identification and assumption surfacing in small groups'. Decision Support Systems, 8: 159-168.

Edelenbos, J and Klij, E.-H. (2007). 'Trust in Complex Decision-Making Network'. Administration & Society, 39(1): 25-50.

Eysenbach, G., Powell, J., Englesakis, M and Rizo, C. (2004). 'Health related virtual communities and electronic support groups: systematic review of the effects of online peer to peer interactions. (BMJ) ', Retrieved July 26, 2011, from http://bmj.com/cgi/pmidlookup?view=long&pmid=15142921. [PMC free article] [PubMed]

Faraj, S., Jarvenpaa, S. L and Majchrzak, A. (2011). 'Knowledge Collaboration in Online Communities'. OrganizationScience, 1-16.

Foong, D. P and McGrouther, D. A. (2010). 'An Internet-based discussion forum as a useful resource for the discussion of clinical cases and an educational tool'. Indian Journal of Plastic Surgery, 43(2): 195–197.

Grounds, A., Gelsthorpe, L., Howes, M., Melzer, D., Tom, B. D., Brugha, T., . . . Meltzer, H. (2004). 'Access to medium secure psychiatric care in England and Wales. 2: A qualitative study of admission decision-making'. The Journal of Forensic Psychiatry & Psychology, 15(1): 32–49.

Hara, N and Hew, K. F. (2007). 'Knowledge-sharing in an online community of health-care professionals'. Information Technology & People, 20(3): 235-261.

Hawn, C. (2009). 'Take Two Aspirins And Tweet Me In The Morning: How Twitter, Facebook, And Other Social Media Are Reshaping Healthcare'. Health Affairs, 28(2): 361-368.

Hicks, R. C., Dattero, R and Galup, S. D. (2007). 'A metaphor for knowledge management: explicit islands in a tacit sea'. Journal of Knowledge Management, 11(1): 5-16.

iHealth Beat Reporting Technology's Impact on Health Care. (2009, Jan 29). 'How Well Are Online Physician Communities Being Received? ' Retrieved Feb 19, 2012, from iHealth Beat Reporting Technology's Impact on Health Care: http://www.ihealthbeat.org/Data-Points/2009/How-Well-Are-Online-Physician-Communities-Being-Received.aspx

Jalal-Karim, A and Balachandran, W. (2008). 'Interoperability Standards: the most requested element for the Electronic Hea15lthcare Records significance'. 2nd International Conference – E-Medical Systems, E-Medisys2008. Tunisia: IEEE.

Kaplan, A. M and Haenlein, M. (2010). 'Users of the world, unite! The challenges and opportunities of Social Media'. Business Horizons, 53: 59—68.

Keselman, A., Logan, R., Smith, C. A., Leroy, G., & Zeng-Treitler, Q. 2008. 'Developing Informatics Tools and Strategies for Consumer-centered Health Communication'. Journal of the American Medical Informatics Association, 15(4): 473-483.

Kietzmann, J. H., Hermkens, K., McCarthy, I. P and Silvestre, B. S. (2011). 'Social media? Get serious! Understanding the functional building blocks of social media'. Business Horizons, 54: 241—251.

Kim, D. J., Ferrin, D. L and Ra, H. R. (2008). 'A trust-based consumer decision-making model in electronic commerce: The role of trust, perceived risk, and their antecedents'. Decision Support Systems, 44: 544– 564.

Kogut, B and Zander, U. (1992). 'Knowledge of the Firm, Combinative Capabilities, and the Replication of Technology'. Organization Science, 3(3): 383-397.

Konito, L. (2011). 'Social Media and Migration: virtual community 2.0'. Journal of the American Society for Information Science and Technology, 62(6): 1075-1086.

Lai, H. F. (28-30 June 2010). 'Applying Fuzzy AHP to Evaluate the Sustainability of Knowledge-based Virtual Communities in Healthcare Industry'. Service Systems and Service Management (ICSSSM), 2010 7th International Conference on Service Systems and Service Management (pp. 1-6). Tokyo, Japan: IEEE Xplore Digital Library.

Louis, K. S., Marks, H. M and Kruse, S. (1996). 'Teachers' Professional Community in Restructuring Schools'. American Educational Research Journal, 33(4): 757-798.

manhattan Research A Decision Resource Group Company. (2012). 'Physician Digital Media Landscape'. Retrieved Jan 19, 2012, from manhattan Research A Decision Resource Group Company: http://manhattanresearch.com/Products-and-Services/Physician/Physician-Research-Modules/Physician-Digital-Media-Landscape

Mansingh, G., Osei-Bryson, K.-M and Reichgelt, H. (2009). 'Issues in knowledge access, retrieval and sharing – Case studies in a Caribbean health sector'. Expert Systems with Applications, 36: 2853–2863.

Mascia, D., and Cicchetti, A. (2011). 'Physician social capital and the reported adoption of evidence-based medicine: Exploring the role of structural holes'. Social Science & Medicine, 72: 798-805.

McDermott, R. (1999). 'Nurturing Three Dimensional Communities of Practice':. Knowledge Management Review. Retrieved Mar 1, 2012, from http://www.co-i-l.com/coil/knowledge-garden/cop/dimensional.shtml

Modahl, M., Tompsett, L and Moorhead, T. (2011). 'Doctors, Patients & Social Media'. Retrieved Feb 26, 2012, from http://www.quantiamd.com/q-qcp/doctorspatientsocialmedia.pdf

Nicholson, B. (2006). 'in my opinion'. Management Today, 10: 10.

Oinas-Kukkonen, H., Lyytinen, K and Yoo, Y. (2010). 'Social Networks and Information Systems: Ongoing and Future Research Streams'. Journal of the Association for Information Systems, 11(2): 61-68.

Parayitam, S. (2010). 'The effect of competence-based trust between physicians and administrative executives in healthcare on decision outcomes'. Management Research Review, 33(2): 174-191.

Peskin, S. (2009). 'Can a Medical 'Facebook' Help Your Plan Thrive? '. Retrieved Feb 6, 2012, from Managed Care:
http://www.managedcaremag.com/archives/0906/0906.socialnetworks.html

Puusa, A and Eerikäinen, M. (2007). 'Is Tacit Knowledge Really Tacit? '. Electronic Journal of Knowledge Management , 8(3): 307-318.

Ranmuthugala, G., Plumb, J. J., Cunningham, F. C., Georgiou, A., Westbrook, J. I and Braithwaite, J. (2011). 'How and why are communities of practice established in the healthcare sector?'. A systematic review of the literature. BMC Health Services Research, 11(1): 273.

Riano, D. (2010). 'A Knowledge-Management Architecture to Integrated and to Share Medical and Clinical Data', Information, and Knowledge. 5943: 180-194.

Roberts, J. (2006). 'Limits to Communities of Practice'. Journal of Management Studies, 43(3): 623-639.

Robertson, B. (2011). 'A Theoretical Method of Measuring Virtual Community Health and the Health of their Operating Environment in a Business Setting'. In B. K. Daniel, Handbook of Research on Methods and Techniques for Studying Virtual Communities: Paradigms and Phenomena (p. 11). Hershey, PA, USA: IGI Global. Retrieved Feb 20, 2012

Ryu, S., Ho, S. H and Han, I. (2003). 'Knowledge sharing behavior of physicians in hospitals' Expert Systems with Applications, 25(1): 113–122.

Sarringhaus, M. M. (2011). 'The Great Divide: Social Media's Role in Bridging Healthcare's Generational Shift'. Journal Of Healthcare Management, 56: 235-244.

Sermo Inc. (2012). 'SERMO PULSE SURVEYS'. Retrieved Mar 17, 2012, from sermo client solutoins: http://clients.sermo.com/images/home/product_sheet/SurveyProductSheet.pdf

Sicilia, M and Palazôn, M. (2008). 'Brand communities on the internet A case of Coca-Cola's Spanish virtual community'. Corporate Communication: An International Journal, 13(3): 255-270.

Stewart, S. A & and Abid, S. S. (2011). 'An Infobutton for Web 2.0 Clinical Discussions: The Knowledge Linkage Framework. IEEE Trans IEEE Transaction on Information' Technology in Biomedicine Technol Biomed.

Tarn, M. J., Wen, J. H and Shih, S. C. (2008). 'A theoretical perspective of man-made system disasters Social-technical analysis and design'. Disaster Prevention and Management, 17(2): 256-280.

Wenger, E. (2006). 'Community of practice'. Retrieved Feb 6, 2012, from Community of practice: http://www.ewenger.com/theory/

Zacks, R. (2007). 'Sermo Strikes Back: A Physicians' Online Community Lashes Out Against Bloggers Who Publicize Security Gap'. Retrieved Jan 26, 2012, from XConomy: http://www.xconomy.com/boston/2007/09/26/sermo-strikes-back-a-physicians-online-community-lashes-out-against-bloggers-who-publicize-security-gap/

APPENDIX

No.	VCoP Name	Source:
1.	National Association of Physician Advisors	http://www.linkedin.com/groupsDirectory?itemaction=mclk&anetid=1860691&impid=&pgkey=anet_search_results&actpref=anetsrch_name&trk=anetsrch_name&goback=%2Egdr_1328943639895_1%2Eanb_1759777_*2_*1_*1_*1_*1_*1%2Eanb_2601905_*2_*1_*1_*1_*1_*1%2Egdr_1328943639901_1%2Egdr_1328943639903_10
2.	The Physician Network	http://www.linkedin.com/groupsDirectory?itemaction=mclk&anetid=3381909&impid=&pgkey=anet_search_results&actpref=anetsrch_name&trk=anetsrch_name&goback=%2Egdr_1328943639895_1%2Eanb_1759777_*2_*1_*1_*1_*1_*1%2Eanb_2601905_*2_*1_*1_*1_*1_*1%2Egdr_1328943639901_1%2Egdr_1328943639903_6
3.	Global Physician Network	http://www.linkedin.com/groupsDirectory?itemaction=mclk&anetid=145957&impid=&pgkey=anet_search_results&actpref=anetsrch_name&trk=anetsrch_name&goback=%2Egdr_1328943639895_1%2Eanb_1759777_*2_*1_*1_*1_*1_*1%2Eanb_2601905_*2_*1_*1_*1_*1_*1%2Egdr_1328943639901_1%2Egdr_1328943639903_12
4.	Group to connect Physician all over world	http://www.linkedin.com/groupsDirectory?itemaction=mclk&anetid=150787&impid=150787-3381909&pgkey=anet_about&actpref=anet_about-gbm&trk=anet_about-gbm-group&goback=%2Egdr_1328943639895_1%2Eanb_1759777_*2_*1_*1_*1_*1_*1%2Eanb_1005057_*2_*1_*1_*1_*1_*1%2Eanb_867307_*2_*1_*1_*1_*1_*1%2Eanb_3381909_*2_*1_*1_*1_*1_*1
5.	The Physician Network	http://www.linkedin.com/groupsDirectory?itemaction=mclk&anetid=3381909&impid=3381909-867307&pgkey=anet_about&actpref=anet_about-gbm&trk=anet_about-gbm-group&goback=%2Egdr_1328943639895_1%2Eanb_1759777_*2_*1_*1_*1_*1_*1%2Eanb_1005057_*2_*1_*1_*1_*1_*1%2Eanb_867307_*2_*1_*1_*1_*1_*1
6.	American Doctors	http://www.linkedin.com/groupsDirectory?itemaction=mclk&anetid=2794764&impid=&pgkey=anet_search_results&actpref=anetsrch_name&trk=anetsrch_name&goback=%2Egdr_1328943639895_1%2Eanb_1759777_*2_*1_*1_*1_*1_*1%2Eanb_2601905_*2_*1_*1_*1_*1_*1%2Egdr_1328943639901_1%2Egdr_1328943639903_5
7.	The Medical Informatics Physician	http://www.linkedin.com/groupsDirectory?itemaction=mclk&anetid=150121&impid=&pgkey=anet_search_results&actpref=anetsrch_name&trk=anetsrch_name&goback=%2Egdr_1328943639895_1%2Eanb_1759777_*2_*1_*1_*1_*1_*1%2Eanb_2601905_*2_*1_*1_*1_*1_*1%2Egdr_1328943639901_1%2Egdr_1328943639903_4
8.	UK Doctors	http://www.linkedin.com/groupsDirectory?itemaction=mclk&anetid=2803122&impid=&pgkey=anet_search_results&actpref=anetsrch_name&trk=anetsrch_name&goback=%2Egdr_1328943639895_1%2Eanb_1759777_*2_*1_*1_*1_*1_*1%2Eanb_2601905_*2_*1_*1_*1_*1_*1%2Egdr_1328943639901_1%2Egdr_1328943639903_6
9.	Middle East Doctors	http://www.linkedin.com/groupsDirectory?itemaction=mclk&anetid=2794771&impid=&pgkey=anet_search_results&actpref=anetsrch_name&trk=anetsrch_name&goback=%2Egdr_1328943639895_1%2Eanb_1759777_*2_*1_*1_*1_*1_*1%2Eanb_2601905_*2_*1_*1_*1_*1_*1%2Egdr_1328943639901_1%2Egdr_1328943639903_7
10.	Medical Doctor (MD) Network	http://www.linkedin.com/groupsDirectory?itemaction=mclk&anetid=1170587&impid=1170587-1759777&pgkey=anet_about&actpref=anet_about-gbm&trk=anet_about-gbm-

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		group&goback=%2Egdr_1328943639895_1%2Eanb_1759777_*2_*1_*1_*1_*1_*1
11.	American College of Physicians	http://www.linkedin.com/groupsDirectory?itemaction=mclk&anetid=867307&impid=867307-1005057&pgkey=anet_about&actpref=anet_about-gbm&trk=anet_about-gbm-group&goback=%2Egdr_1328943639895_1%2Eanb_1759777_*2_*1_*1_*1_*1_*1%2Eanb_1005057_*2_*1_*1_*1_*1_*1
12.	American Board of Physician Specialists (ABPS)	http://www.linkedin.com/groupsDirectory?itemaction=mclk&anetid=1882809&impid=&pgkey=anet_search_results&actpref=anetsrch_name&trk=anetsrch_name&goback=%2Egdr_1328943639895_1%2Eanb_1759777_*2_*1_*1_*1_*1_*1%2Eanb_2601905_*2_*1_*1_*1_*1_*1%2Egdr_1328943639901_1%2Egdr_1328943639903_13
13.	Astute Physician	http://www.linkedin.com/groupsDirectory?itemaction=mclk&anetid=1894343&impid=&pgkey=anet_search_results&actpref=anetsrch_name&trk=anetsrch_name&goback=%2Egdr_1328943639895_1%2Eanb_1759777_*2_*1_*1_*1_*1_*1%2Eanb_2601905_*2_*1_*1_*1_*1_*1%2Egdr_1328943639901_1%2Egdr_1328943639903_22
14.	Chinese Doctors	http://www.linkedin.com/groupsDirectory?itemaction=mclk&anetid=2794776&impid=&pgkey=anet_search_results&actpref=anetsrch_name&trk=anetsrch_name&goback=%2Egdr_1328943639895_1%2Eanb_1759777_*2_*1_*1_*1_*1_*1%2Eanb_2601905_*2_*1_*1_*1_*1_*1%2Egdr_1328943639901_1%2Egdr_1328943639903_17
15.	Global Surgeons and Physician Professional Network	http://www.linkedin.com/groupsDirectory?itemaction=mclk&anetid=2070023&impid=&pgkey=anet_search_results&actpref=anetsrch_name&trk=anetsrch_name&goback=%2Egdr_1328943639895_1%2Eanb_1759777_*2_*1_*1_*1_*1_*1%2Eanb_2601905_*2_*1_*1_*1_*1_*1%2Egdr_1328943639901_1%2Egdr_1328943639903_17
16.	MDSNe - Medical Doctors Social Networking	http://www.linkedin.com/groupsDirectory?itemaction=mclk&anetid=3457609&impid=&pgkey=anet_search_results&actpref=anetsrch_name&trk=anetsrch_name&goback=%2Egdr_1328943639895_1%2Eanb_1759777_*2_*1_*1_*1_*1_*1%2Eanb_2601905_*2_*1_*1_*1_*1_*1%2Egdr_1328943639901_1%2Egdr_1328943639903_22
17.	If you are. Canadian Physician wanting a chance in city. Contact me	http://www.linkedin.com/groupsDirectory?itemaction=mclk&anetid=3368246&impid=&pgkey=anet_search_results&actpref=anetsrch_name&trk=anetsrch_name&goback=%2Egdr_1328943639895_1%2Eanb_1759777_*2_*1_*1_*1_*1_*1%2Eanb_2601905_*2_*1_*1_*1_*1_*1%2Egdr_1328943639901_1%2Egdr_1328943639903_31
18.	MCMS Physician Members	http://www.linkedin.com/groupsDirectory?itemaction=mclk&anetid=2209280&impid=&pgkey=anet_search_results&actpref=anetsrch_name&trk=anetsrch_name&goback=%2Egdr_1328943639895_1%2Eanb_1759777_*2_*1_*1_*1_*1_*1%2Eanb_2601905_*2_*1_*1_*1_*1_*1%2Egdr_1328943639901_1%2Egdr_1328943639903_38
19.	Northshore University Healthsystem Physician Group	http://www.linkedin.com/groupsDirectory?itemaction=mclk&anetid=4121118&impid=&pgkey=anet_search_results&actpref=anetsrch_name&trk=anetsrch_name&goback=%2Egdr_1328943639895_1%2Eanb_1759777_*2_*1_*1_*1_*1_*1%2Eanb_2601905_*2_*1_*1_*1_*1_*1%2Egdr_1328943639901_1%2Egdr_1328943639903_38
20.	New England Physician Network	http://www.linkedin.com/groupsDirectory?itemaction=mclk&anetid=2893071&impid=&pgkey=anet_search_results&actpref=anetsrch_name&trk=anetsrch_name&goback=%2Egdr_1328943639895_1%2Eanb_1759777_*2_*1_*1_*1_*1_*1%2Eanb_2601905_*2_*1_*1_*1_*1_*1%2Egdr_1328943639901_1%2Egdr_1328943639903_34
21.	American Association of	http://www.linkedin.com/groupsDirectory?itemaction=mclk&anetid=76197&impid=&pgkey=anet_search_results&actpref=anetsrch_name&trk=anetsrch_name&goback=%2Egdr_1328943639895_1%2Eanb_1759777_*2_*1_*1_*1_*1_*1%2Eanb_2601

	Physician Specialists	905_*2_*1_*1_*1_*1_*1%2Egdr_1328943639901_1%2Egdr_1328943639903_24
22.	Physician Alignment, integration and Operations	http://www.linkedin.com/groupsDirectory?itemaction=mclk&anetid=3848200&impid=&pgkey=anet_search_results&actpref=anetsrch_name&trk=anetsrch_name&goback=%2Egdr_1328943639895_1%2Eanb_1759777_*2_*1_*1_*1_*1_*1%2Eanb_2601905_*2_*1_*1_*1_*1_*1%2Egdr_1328943639901_1%2Egdr_1328943639903_24
23.	Thai Physicians	http://www.facebook.com/groups/morthai/
24.	Naturopathic Physicians	http://www.facebook.com/groups/160969783925161/
25.	APPNA Young Physicians	http://www.facebook.com/groups/308140919099/
26.	Thai American Physicians Foundation	http://www.facebook.com/groups/104301007309/
27.	PIT Physicians Support Group	http://www.facebook.com/groups/191228040917719/
28.	Physician_pharmacist club	http://www.facebook.com/groups/255294724513946/
29.	Arcadia Physician Assistant Rotations	http://www.facebook.com/groups/95913190853/
30.	USMLE for Thai Physicians	http://www.facebook.com/groups/USMLE4Thai/
31.	New York State Society of Physician Assistants	http://www.facebook.com/groups/123645519733
32.	Residency Ready Physicians	http://www.facebook.com/groups/ResidencyReadyPhysicians/
33.	Columbia College of Physicians and Surgeons Class of 2015	http://www.facebook.com/groups/206743702674113/
34.	Physicians + Facebook Marketing - How to do it correctly!	http://www.facebook.com/groups/142993412412626/
35.	SUNY Downstate	http://www.facebook.com/groups/125565622478/

	Physician Assistant Alumni Group	
36.	Egyptian Women Physicians and Scientists	http://www.facebook.com/groups/186275698090831/
37.	SERMO	http://www.sermo.com/about/introduction
38.	QuantiaMD	http://www.quantiamd.com/
39.	Epocrates	http://www.epocrates.com/

Table 4.   Integrated Framework Implementation results – Case of on LinkedIn, Facebook & Professional HC VCoPs