

Creating Collaborative Innovation Networks (COINs) to Reduce Infant Mortality

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Abstract This case study illustrates the growth process of a collaborative innovation network in healthcare. It tracks e-mail communication of COIN members through a method we call “virtual mirroring”, and measures the online perception of the topics of the COIN by coolhunting on social media such as Twitter and blogs. It also describes how the COIN members through “coolfarming” self-organize and identify new sub-topics for their work. In particular, the paper describes the growth process of the US Department of Health and Human Services Infant Mortality CoIIN (Collaborative Improvement and Innovation Network), applying both improvement and innovation concepts to reducing infant mortality among disadvantaged families in the US.

1 Introduction

Collaborative Innovation Networks (COINs) are self-organizing groups of intrinsically motivated people who get together to create something radically new (Gloor 2006). While they occasionally meet face-to-face, they mostly collaborate over the Internet to innovate and change the world. In this case study we illustrate the COIN creation and growth process by studying the communication among COIN team members inside the organization through e-mail, and outside the organization by examining social media. In particular, we demonstrate the use of e-mail based social network analysis and virtual mirroring to measure and support the growth of the IM-CoIIN project of the Maternal and Child Health Bureau (MCHB) of the US Health Resource Administration (HRSA). “IM-CoIIN” stands for “Infant Mortality reduction Collaborative Improvement and Innovation Network”. It is defined as “a multiyear national movement engaging federal, state and local leaders, public and private agencies, professionals, and communities to employ quality improvement, innovation and collaborative learning to reduce infant mortality and improve birth outcomes”. The project was started in 2012,

and will be completed in 2017 and is active in all states of the US. The CoIIN as envisioned by the MCHB Associate Administrator combines both improvement and innovation concepts. For the improvement part IM-CoIIN applies the IHI breakthrough model (IHI2003), which brings together healthcare practitioners to one to two day learning sessions, where they share their experiences to learn from each other and improve their own healthcare processes. For innovation, IM-CoIIN is based on the COIN concept, trying to nurture breakthrough innovation in collaborative innovation networks.

As part of the IM-CoIIN, six sub-CoIINs were created: the first CoIIN has been working on improving safe sleep practices for babies. The second CoIIN is trying to get smoking mothers to stop or at least reduce smoking before, during and after pregnancy. The third CoIIN focuses on improving women's health before, after and in between pregnancies. The fourth CoIIN works to improve social determinants of health (SDOH) and equity in birth outcomes. The fifth CoIIN is trying to prevent births before 39 weeks. The sixth CoIIN works to increase the delivery of higher risk infants and mothers at appropriate level facilities.

In the remainder of this paper, we will first describe the e-mail based virtual mirroring process of the entire IM-CoIIN, then we will describe how we did coolhunting for SDOH related topics on online social media to get the innovation aspect of this sub-CoIIN started, and finally describe how we brought together small groups of innovators to coolfarming workshops to create new COINs around SDOH.

2. E-Mail Based Virtual Mirroring

Our first step was to apply the virtual mirroring process which promotes self-reflection and ultimately impacts organizational performance (Gloor et al. 2017b; Gloor et al 2010). Virtual mirroring involves measuring communication patterns and mirroring the resulting social network variables back to the individual. In this study we conducted virtual mirroring sessions of 7 key members of the SDOH community based on their e-mail archives from November 2014 to March 2016. Similarly to feedback or learning sessions, which are commonly used in industrial and social psychology studies (Ramos 2007), our virtual mirroring process is a way to promote organizational awareness and change. In a recent study, Gesell et al. (2013) presented social network analysis results to organizational leaders to support change management programs. The healthcare sector is also becoming increasingly interested in measuring information flows and team dynamics among physicians, nurses and other healthcare professionals. Grippa and colleagues (2012) involved three interdisciplinary care delivery teams in similar monthly learning sessions focused on social network-based results, which resulted in an increased awareness that informed decision making. Very recently, Gloor and colleagues (2017) involved leaders of 26 large accounts in monthly virtual

mirroring sessions, where the communication characteristics of the teams working with clients were shared and discussed in plenary and individual sessions. In their study they measured the structure of the communication network, looking at who is interacting with whom, the average complexity of the vocabulary used, as well as the responsiveness of employees to customers' e-mails.

Another recent study (Gloor et al 2017b) found that customer satisfaction increases after employees are involved in learning sessions to reflect on their own communication behaviors. In their study, Gloor, Colladon, Giacomelli, Saran and Grippa (2017) correlated employees' communication patterns with customer satisfaction and found that responsiveness, low oscillation of betweenness centrality, and complexity of communication are good predictors of customer satisfaction.

2.1 Virtual Mirroring: Dimensions and Metrics

The process of virtual mirroring relies on e-mail based social network analysis. We provided feedback to the IM-CoIIN community presenting them with results based on three dimensions: degree of connectivity, content sharing and degree of interactivity (Gloor 2006, p. 175). *Connectivity* refers to how well connected individuals are within their social network using indicators such as betweenness centrality and degree centrality (Everett & Borgatti, 2005; Wasserman & Faust, 1994). The second dimension, degree of *sharing*, describes the complexity of the language used based on the average difficulty of the words in each e-mail. Complexity is calculated as the likelihood distribution of words within an e-mail text, i.e. the probability of each word of a dictionary to appear in the text (Brönnimann 2014). The algorithm used to calculate complexity measures how common a word is in an individual message compared to the word's occurrence in the overall text collection; the more relatively rare words a message uses, the higher is the message's complexity. Beside complexity, we also extracted a *sentiment* indicator based on a multi-lingual classifier that uses a machine learning method trained on large datasets from Twitter (Brönnimann, 2014). Finally, we included *emotionality* which is measured as standard deviation of sentiment: the more fluctuations in positivity and negativity an e-mail has, the more emotional it is.

The third dimension of our virtual mirroring model, *interactivity*, includes metrics such as contribution index and average response time (ART) of an actor to respond to a message. Contribution index is calculated as the frequency of sending and receiving messages: it is +1 if somebody only sends messages and does not receive any; it is -1 if somebody only receives messages; it is 0, if somebody sends and receives the same number of messages. The average response time (ART) indicates how fast an individual or a group responds to e-mails, offering some insights into the degree of "respect" and "passion" within the community.

We also distinguished between “alter ART” and “ego ART”. These metrics are part of the six honest signals of collaboration described in (Gloor 2017).

In other studies, we have been able to demonstrate that the faster other people respond to a person, the more they respect this person. For example, in a recent study on managerial turnover and online communication behavior (Gloor et al 2017a), turnover is associated to e-mail responsiveness, mainly in terms of nudges shared with colleagues: the more frequently managers interact with others, the more central they are and the more nudges they send and receive, the less likely they are to quit. This could be possibly explained with an increase in respect and political power that managers have acquired over time. In the same study, Gloor et al (2017a) found that language complexity was a good predictor of managerial turnover: managers who stay in their job tend to express themselves in a less emotional way, switching to a more emotional content over time as they approach the time they quit. These results are aligned with Pennebaker’s research (2001 and 2011) indicating that life-changing events influence the use of both positive and negative emotion words.

To measure collaboration among the IM-CoIIN members, we collected all IM-CoIIN related e-mails of seven key participants of the IM-CoIIN from September 2014 to March 2016 using the software tool Condor (Gloor 2017). We had shown in earlier work that having 14% to 18% of the mailboxes of a community was adequate to capture 90% of their e-mail traffic, thanks to community members cc’ing each other (Zilli et al. 2006). Through this virtual mirror of seven key members of the community based on their e-mail archives we were able to give feedback to the entire community and come up with recommendations for improved collaboration.

2.2 Virtual Mirroring Applied to the DSOH community

Figure 1 illustrates the overall e-mail activity of the community over the entire time period from September 2014 to March 2016. The community sent up to 3000 messages on the most active days, with an average of 500 messages per day, the weekends are clearly visible with much less traffic. The periods of intense communication and high activity are recognizable by slopes in the evolution of group betweenness centrality and high-density structure of the community. The spikes indicate the time right before a learning session, when the organization running the community (NICHQ, a Boston-based non-profit) reached out to health officials and administrators in the 52 US States inviting them to the learning sessions.

Fig. 1. Activity of e-mail from Sept 2014 to March 2016

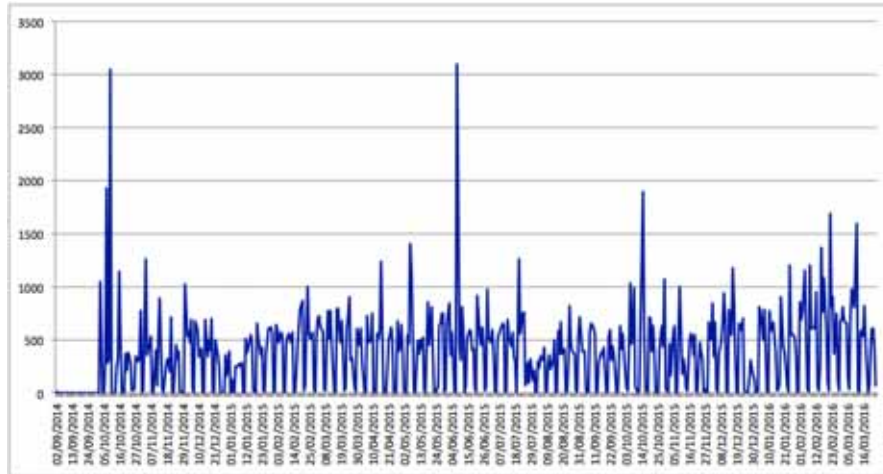


Figure 2 illustrates the average speed with which everybody within the community answers to e-mails sent by the seven owners of the mailboxes we collected. In this analysis, we found that alter ART started at an already respectable 25 hours, and has been decreasing to a quite fast 17 hours on average until an e-mail was answered. This means that mutual respect in this community has been going up clearly over the observation period of 18 months, a very positive sign of organizational health.

Fig. 2. Average response time of others to the mailbox owners (Alter ART)

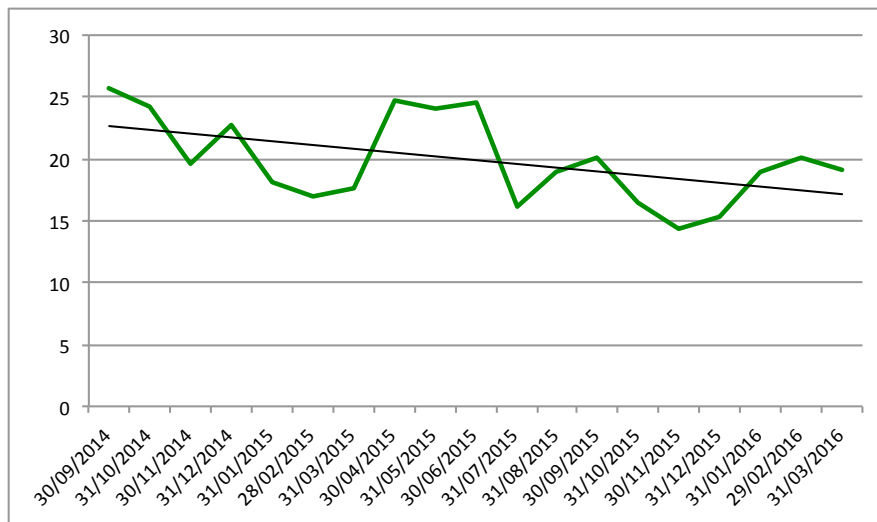


Figure 3 illustrates the change of ego ART, which is defined as the speed with which the owner of a mailbox answers to everybody else (Gloor 2017). The speed with which somebody answers to everybody else's e-mails is a proxy for the passion of the person. In this community, ego ART starts at below 20 hours on average, and stays like that for the entire observation period. While we would have wished for an even stronger decrease in egoART, what we can say is that passion is high to start with, and stays like that over the 18 months observation period.

Fig. 3 Average response time of mailbox owners to all others (Ego ART)

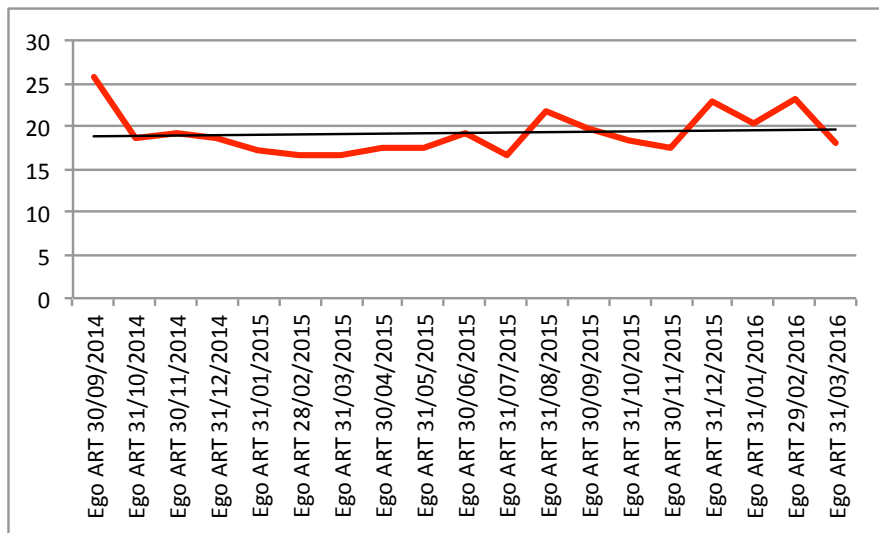


Figure 4 illustrates the number of new contacts per person per month. A new contact is only counted if it has at least one e-mail exchange, this means that if person A sends an e-mail to person B, B needs to respond to it. This exchange is included, if person B appears for the first time in the analysis of the particular month. The number of new e-mail contacts is a good proxy for the growth dynamics of a community. Figure 4 tells us that growth per month more than doubled from on average 250 new community members to on average over 600 new community members per month at the end of the observation period. It illustrates the healthy growth of IM-CoIIN, which is confirmed in the real world, where participation in the learning sessions has been steadily going up.

Fig. 4. Number of new e-mail contacts per month

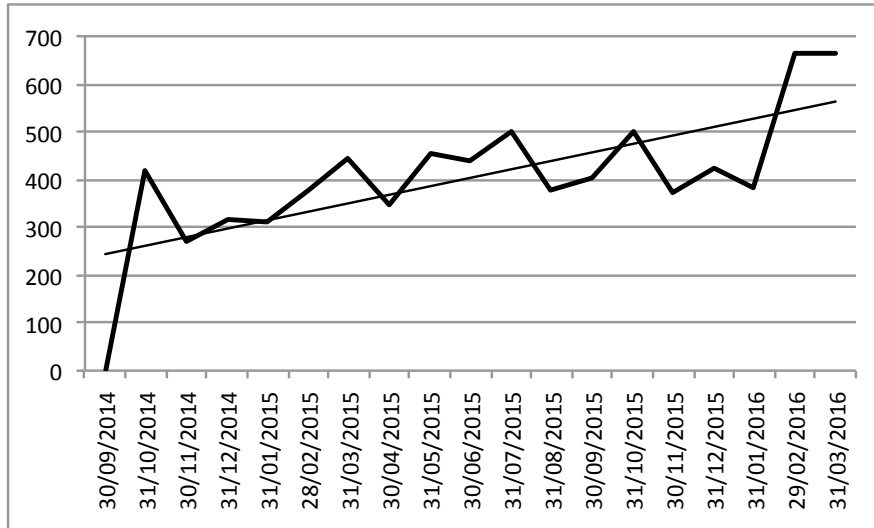


Figure 5 shows the temporal social surface, which is a visual way to explore the creative capabilities of a community. The x-axis of figure 5 shows all actors involved, the y-axis shows time, from September 2014 at top left, to March 2016, at the bottom center. The z-axis shows betweenness centrality (Wassermann & Faust 1994) of each actor. The spikes at the rear of figure 5 display that a few people are always more central than the rest, exhibiting strong leadership. The growth pattern of figure 4 is again confirmed, in that the plateau, which shows the somewhat active participants, is growing over time. But we also see that the creativity of the entire community is relatively low, as the entire impression of figure 5 is one of a “calm sea”, and not one of a “stormy ocean”, which would indicate a lot of rotating leadership, which is a strong predictor of a creative community. The impression arising from this analysis is one of steady improvement, and not of radical innovation.

Fig. 5. Temporal Social Surface of combined mailboxes, a visualization of team creativity

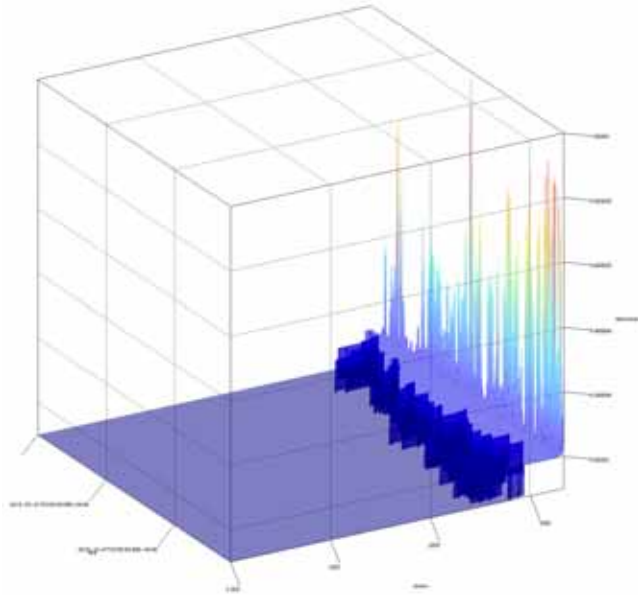


Figure 6 illustrates the social network structure of the entire e-mail network. Each dot is a person, each connecting line means that two people have at least exchanged one e-mail. The coloring by organization shows that the largest group of participants, not surprisingly, is from the US government from HRSA, followed by members of the non-profit organizations “March of Dimes” and NICHQ. The most central people measured by betweenness centrality in Figure 6 are the project coordinator from HRSA, as well as the project director from NICHQ.

Fig. 6. E-Mail social network of entire community (top 4000 users by communication frequency shown)

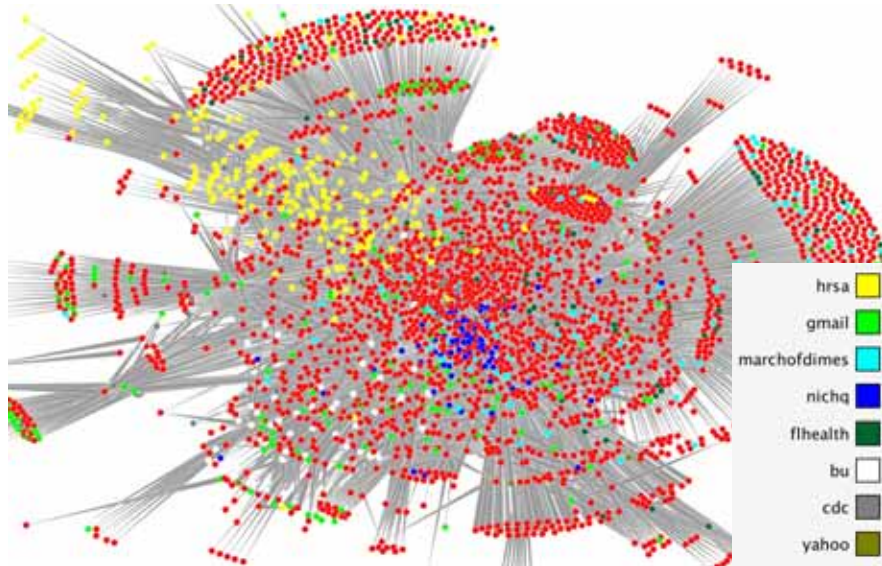


Figure 7 shows the sentiment and activity over the observation period. We find that the sentiment is strongly positive, from 0.6 to 0.73. Sentiment of 0.5 is defined as neutral. This tells the observer that IM-CoIIN participants are very nice to each other, use positive language and give a lot of praise to each other. At the same time, the oscillation in sentiment also indicates that occasionally they are not shy of speaking out if something is not going as it should, which is a sign of an open and honest communication.

Fig. 7. Sentiment and Activity of e-mail from Sept 2014 to March 2016

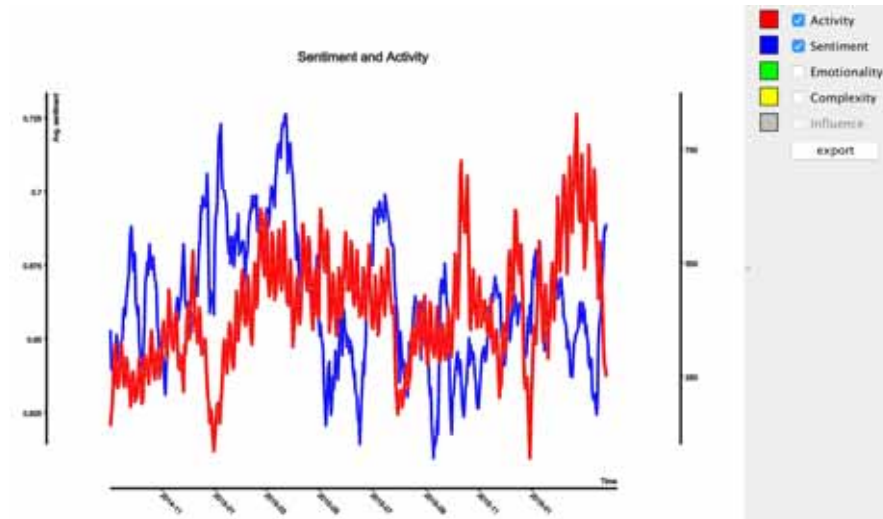
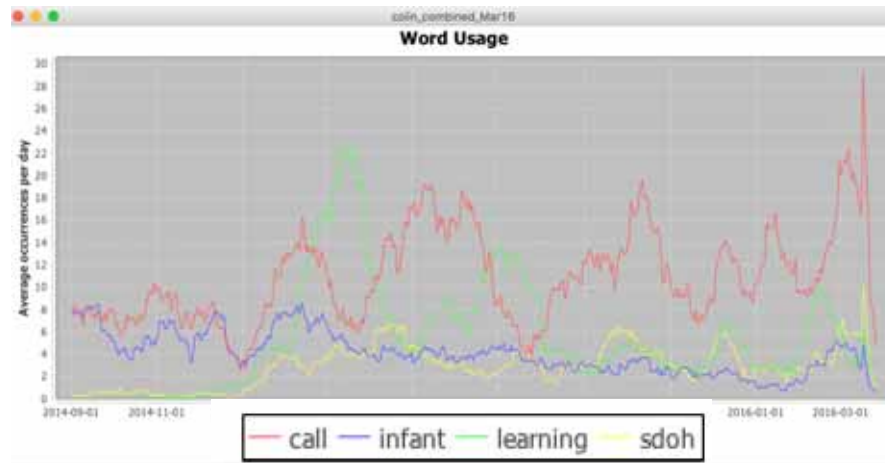


Figure 8 shows the word usage over time of the most frequently used words in the e-mails over the 18-month observation period. “Call” is the most popular word, used with increasing frequency over time, which tells us that setting up calls among participants is the most important activity of the IM-CoIIN. Somewhat surprising, the use of the word “infant” is going down over time. “Learning” is peaking beginning of 2015, when a face-to-face learning session was organized. The term “SDOH” (social determinants of health) is becoming somewhat more popular, as a COIN around this concept is developing. Overall, it emerges a picture of a community focused mostly on execution, indicated through usage of the term “call”, surfaces, with a smaller focus on innovation, indicated through the term “SDOH”.

Fig. 8. Key concepts over time



To resume this analysis, through analyzing the e-mail communication of the IM-CoIIN community, we have been able to gain deep insights into the inner workings and knowledge flow of the community. We find that the community is showing healthy growth, and community members are treating each other with passion and respect. However, we also find that the community is focusing mostly on improvement, with the innovation component of the CoIIN somewhat lagging behind.

3 SDOH Coolhunting

To address the innovation aspect in IM-CoIIN, project leadership decided to set up an innovation COIN (with one “I”) focused on social determinants of health (SDOH). As part of helping to get the SDOH COIN started, we conducted a coolhunting on Twitter and on the Web to identify the key terms around social determinants of health, and to collect innovative new ideas. Coolhunting is based on a degree-of-separation search that allows to quickly find the most influential nodes in a relevant subset of the Web. Combining multiple datasets, each containing the degree of-separation Web sites collected through querying a search engine for the name of one search term (SDOH in our case), allowed us to find the most central node in a group of stars (Gloor 2006).

For the coolhunting, we collected key words from SDOH experts who are part of the IM-CoIIN. Topics they identified were to “reduce poverty”, increase the “graduation rate” among disadvantaged teenagers, increase the “minimum wage”, and increase general “happiness”. Figure 9 shows the results of our coolhunting using Condor for these search terms on Twitter (Gloor, 2017). The Twitter

network picture in Condor measures the importance of search terms through their betweenness centrality in the bipartite graph. Each node except the search term is a Twitter user, each connecting line means that the user is tweeting about the term, or is mentioned in a tweet by another user, or is retweeting somebody else's tweet. The main conclusion in figure 9 is that "minimum wage" is the most important term, while SDOH is rarely tweeted about, as shown in the pink little cluster at the very right of the picture, and the low betweenness centrality in the comparative bar chart.

Fig. 9. Twitter Coolhunting Results for SDOH

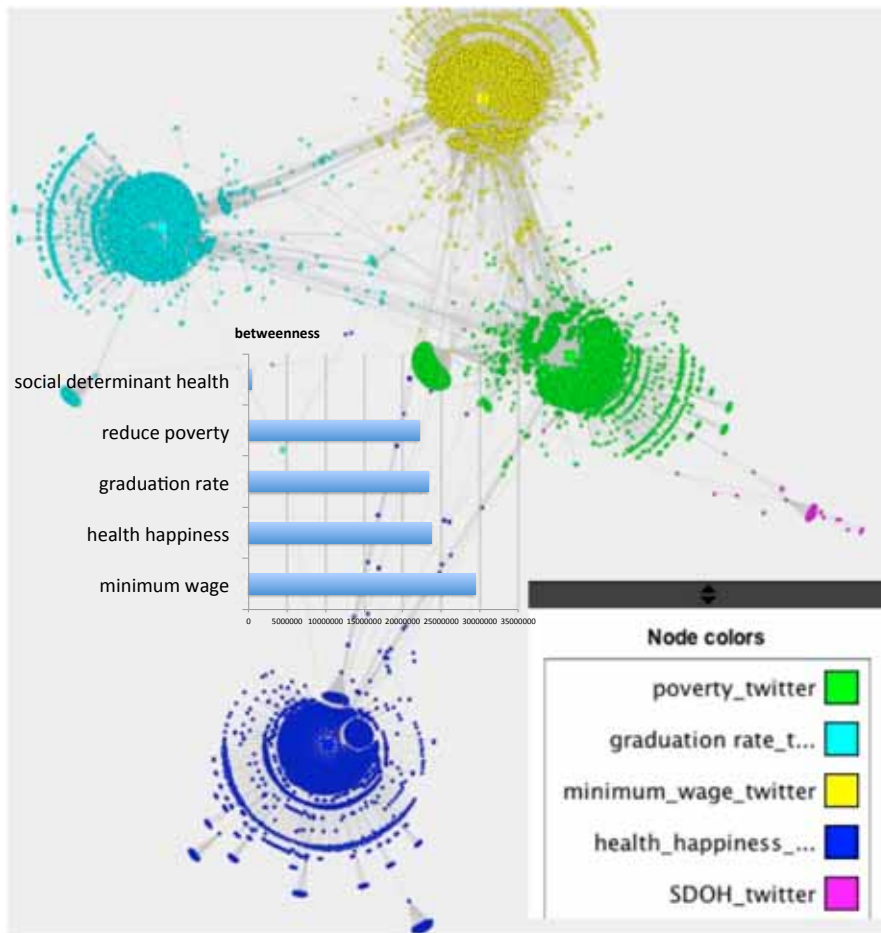


Figure 10 shows the word cloud illustrating the key attributes of the four main search terms. The green color of words indicates that they are used in positive context, the red words are using in negative context. Health and happiness are the most important, and most positive words in our Twitter search, minimum wage and poverty the most important negative words.

Fig. 10. Coolhunting Results for all SDOH related terms on Twitter



Figure 11 shows the occurrence of the search terms on the World map. Minimum wage is a big topic in both North America and in Europe, however graduation is not an issue in Europe, where education is basically free. The Irish union SIPTU comes up in Europe, as it is talking about a raise in minimum wage in Ireland considered insufficient by SIPTU. In Asia the “harvesting happiness” talk radio show of host Lisa Cypers Kamen is mentioned.

Fig. 11. Global distribution of Coolhunting Results for SDOH on Twitter



Figure 12 illustrates an identical search done on the Web for the same search terms. Minimum wage is again the biggest topic, but social determinants of health are more popular on the Web than they are on Twitter. This is most likely because SDOH is a relatively complex topic, which is better explained in blog posts than in the 140 characters of Twitter. We can also identify the most important newsfeeds about these topics, such as PBS and NPR, and the Robert Wood Johnson Foundation.

Fig. 12. Key search terms and Web sites about SDOH on the Web

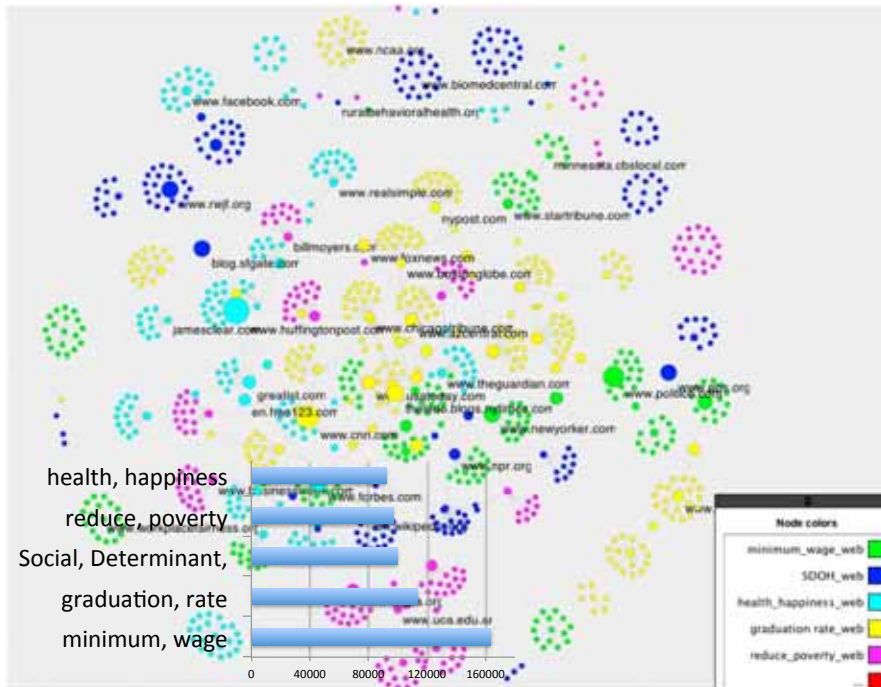


Figure 13 shows the most important attributes related to the search terms. The context seems more positive, as more words are in green. The words are also more factual and less emotional, such as “education”, “news”, “resources”, and “information”. What stands out is the “state of Texas”.

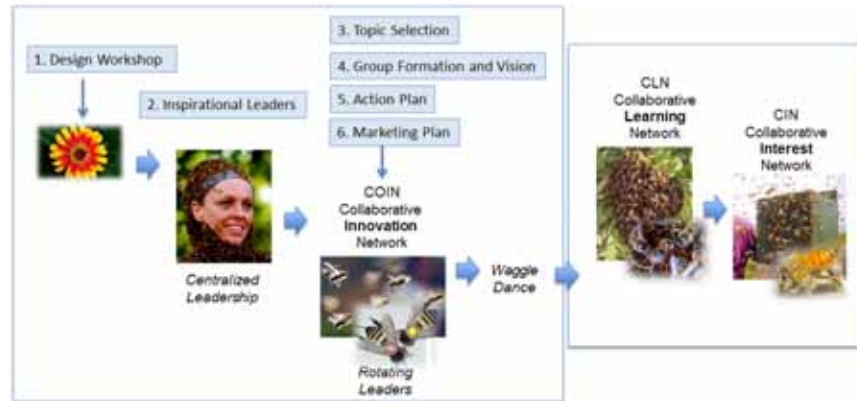
Fig. 13. Coolhunting results for all SDOH related terms on the Web

Based on the insights from this coolhunting, it was decided to invite a small group of IM-CoIIN members passionate about SDOH to coolfarming workshops, to meet for half a day before a learning session and brainstorm innovative ideas to create new COINs.

4 Creating New COINs

We conducted two half-day workshops with the goal to create new COINs to reduce infant mortality, tackling social determinants of health as a new initiative. The goal was to reach out to innovative people with far out ideas, who were interested in developing them further and recruit a team to work with turning their ideas into a first prototype. Figure 14 describes the full COIN creation process (Gloor 2017b). At the beginning a small group of enthusiasts gets together for an initial brainstorming workshop, where the topics of the COIN are defined. Such an initial design workshop to create a new COIN follows a six-step process. In the first step workshop participants are familiarized with key COIN concepts such as rotating leadership and balanced contribution. In the second step, inspirational leaders - who have solved similar problems in other areas - are invited to present their approach and get the creative thinking of participants going. During step three of the COIN creation process, participants list and select the topics they would like to turn into products of COINs. Step four consists of the creation of small groups around each topic for a COIN, working on developing a vision for their COIN. Once they have defined the vision, step five requires participants to map out an action plan. In the final, sixth step COIN members do a “waggle dance”, developing a marketing plan to recruit additional outside COIN members.

Fig. 14. Coolfarming and COIN Creation Process



Not all topics at the workshop will become successful COINs. COINs with passionate leaders will recruit more members for their COIN, and do an in-depth coolhunting to learn what's already out there and available. They will set up regular meetings, do more coolhunting, set up a Website, advertise their COIN, and grow the community. As the community grows, other communities get created as a product of the COINs members' "waggle dance". Gloor (2006) found that through the application of social analysis, it is possible to recognize two types of these networks: Collaborative Interest Network (CIN) and Collaborative Learning Networks (CLN). Members of a CLN share a common interest, knowledge and a practice, being motivated to join the network by a desire to learn from each other. Members of CIN have similar interests, without necessarily working together. Both CLN and CIN tend to be characterized by specific network properties, such as lower density and high group centrality, since external members are mainly connected to core members, but not among themselves.

Collaborative Interest Networks and Collaborative Learning Networks are created through the same waggle dance and spreading of "attraction pheromones" that is at the basis of the creation of COINs. To continue with the metaphor, "Coolhunter bees mark the location of the new hive by spraying it with attraction pheromone, such that the flying swarm of bees will find their goal irresistible as soon as they get close. At the same time, the coolhunting bees will direct the flying swarm by rapidly flying back and forth in the midst of the flying cloud of bees" (Gloor, Margolis and Dellal, 2012, p.12).

5 Discussion and Conclusion

In this paper we have illustrated the use of virtual mirroring, coolhunting, and coolfarming to create COINs. While our case study focused on the HRSA IM-CoIIN to reduce infant mortality in the US, this process is widely applicable. It has been applied in other healthcare environments, for instance for patients of chronic diseases as described in (Gloor 2017b), but it has much wider applicability. COINs offer huge potential for any organization not afraid of creating an environment supportive of disruptive innovation.

The two workshops conducted at IM-CoIIN learning sessions led to the creation of a vibrant COIN on the impact of early childhood trauma inspired by the ACES (Adverse Childhood Experiences) study. Three more COINs, on Babybox for safe sleep (giving poor mothers a cushioned cardboard box as a baby bed), doulas (women trained to assist mothers at childbirth), and “Care Bundles” (groups of services provided to mothers on welfare) are in the process of being formed.

Through the application of a virtual mirroring process, we offered community members the opportunity to reflect on their communication styles. A longitudinal analysis of the e-mail communication patterns of the community “Social Determinants of Health” indicated an exponential growth in only a few months (150% more members). Over 16 months, there was an increase in both the degree of respect (reduced average response time) and passion (average response time of 20 hours). By measuring sentiment, emotionality and complexity of the content exchanged via e-mail, we noticed that the community exchanged a creative, emotional, though positive response.

The application of the virtual mirroring to the SDOH community is based on extensive previous studies demonstrating how promoting self-awareness of people’s communication style has the potential to induce behavior change and increase organizational effectiveness. This is aligned with the results of several studies on the effect of feedback sessions on individual, team and organizational performance (Kluger and DeNisi 1996; Barr and Conlon 1994; Ivancevich and McMahon 1982), which indicated that providing employees with the opportunity to reflect on their performance could enable positive behavioral change. Virtual mirroring sessions take this approach to a deeper level, by providing monthly description of individuals’ communication patterns. This continuous mirroring process lets individuals receive timely and practical information about their communication patterns that can be used to improve their individual and community performance.

Besides reflecting on their own online communication, participants were offered the opportunity to visualize topics that were attracting the interest of the swarm. Through the Coolhunting process, community leaders were able to recognize the importance of themes that impacted infant mortality, such as reducing poverty, increasing the graduation rate among teenagers, increasing the minimum wage, and promoting general happiness. The process helped community

leaders to identify important terms used by online users in various parts of the world, such as minimum wage and poverty. Creating new COINs and coolhunting for trends on the Web represent important methods to help design quality improvement initiatives. Similarly, virtual mirroring gave participants the ability to recognize the impact of their communication behavior, and to observe how their connections grew across and beyond the community boundaries.

References

1. Barr, S.H., and Conlon, E.J. (1994). Effects of distribution of feedback in work groups. *Academy of Management Journal*, 37, 641–655.
2. Brönnimann, L. (2014) Analyse der Verbreitung von Innovationen in sozialen Netzwerken. M.Sc. Thesis, University of Applied Sciences Northwestern Switzerland. See also <http://swarmcreativity.blogspot.com/2014/03/how-to-measure-influence-in-social.html>
3. Gesell S. B., Barkin S. L., and Valente T. W. (2013) Social Network Diagnostics: a Tool for Monitoring Group Interventions, *Implementation Science* 8, 116.
4. Gloor P.A. (2006) *Swarm Creativity. Competitive Advantage through Collaborative Innovation Networks*. Oxford University Press, NY.
5. Gloor PA (2011) *Coolfarming: Turn Your Great Idea into the Next Big Thing*. New York. AMACOM.
6. Gloor, P., P. Margolis, M. Seid, G. Dellal. 2012. Coolfarming – Lessons from the Beehive to Increase Organizational Creativity. MIT Center for Collective Intelligence, 1 - 20.
7. Gloor, P., Colladon, A.F., Giacomelli, G., Saran, T. and Grippa, F., (2017). The impact of virtual mirroring on customer satisfaction. *Journal of Business Research*, 75, pp.67-76.
8. Gloor, P.A. (2017) *Sociometrics and Human Relationships: Analyzing Social Networks to Manage Brands, Predict Trends, and Improve Organizational Performance*. Emerald Publishers
9. Gloor, P.A. (2017b) *Swarm Leadership and the Collective Mind: Using Collaborative Innovation Networks to Build a Better Business*. Emerald Publishers
10. Gloor, P.A., Oster, D., Raz, O., Pentland, A. and Schoder, D., (2010). The virtual mirror: Reflecting on the social and psychological self to increase organizational creativity. *International Studies of Management & Organization*, 40(2), pp.74-94.
11. Gloor, Peter A. "What e-mail reveals about your organization." *MIT Sloan Management Review* 57, no. 2 (2016): 8.
12. Gloor, P. A., Colladon, A. F., Grippa, F., & Giacomelli, G. (2017a). Forecasting managerial turnover through e-mail based social network analysis. *Computers in Human Behavior*, 71, 343-352.
13. Gloor, P., Colladon, A. F., Giacomelli, G., Saran, T., & Grippa, F. (2017b). The impact of virtual mirroring on customer satisfaction. *Journal of Business Research*, 75, 67-76. <http://dx.doi.org/10.1016/j.jbusres.2017.02.010>

14. Grippa, F., Gloor, P.A., Bucuvalas, J.C. and Palazzolo, M. (2012) Supporting development efforts of clinical care teams, *International Journal of Organisational Design and Engineering* 2(2), 149–166.
15. IHI (2003) *The Breakthrough Series: IHI's Collaborative Model for Achieving Breakthrough Improvement*. IHI Innovation Series white paper. Boston: Institute for Healthcare Improvement. (Available on www.IHI.org)
16. Ivancevich J. M. and McMahon, J. T. (1982). The effects of goal setting, external feedback, self-generated feedback on outcome variables: A field experiment. *Academy of Management Journal*, 25(2), 359–372.
17. Kluger, A. N., & DeNisi, A. (1996). The effects of feedback interventions on performance. A historical review, a meta-analysis, and a preliminary feedback intervention theory. *Psychological Bulletin*, 119, 254–284.
18. Marcos de Oliveira, J. Gloor, P. (2016) *The Citizen IS the Journalist - Automatically Extracting News from the Swarm*. Rome, Italy June 9-11, 2016, *Designing Networks for Innovation and Improvisation: Proceedings of the 6th International COINs Conference* (Springer Proceedings in Complexity)
19. Pennebaker, J. W. (2011). The secret life of pronouns. *New Scientist*, 211(2828), 42-45.
20. Pennebaker, J. W., Francis, M. E., & Booth, R. J. (2001). *Linguistic inquiry and word count: LIWC 2001*. Mahway: Lawrence Erlbaum Associates, 71.
21. Ramos, C. M. (2007). Organizational change in a human service agency. *Consulting Psychology Journal: Practice and Research*, 59(1), 41.
22. Wasserman, S., & Faust, K. (1994). *Social network analysis: Methods and applications* (Vol. 8). Cambridge university press.
23. Zilli, A., Grippa, F., Gloor, P., & Laubacher, R. (2006). One in four is enough—strategies for selecting ego mailboxes for a group network view. In *Proc. European Conference on Complex Systems ECCS* (Vol. 6, pp. 25-29).