Enhancing Social and Intellectual Collaboration in Innovation Networks: A Study of Entrepreneurial Networks in an Urban Technological University

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The purpose of this paper is to document efforts to build collaborative networks of faculty, staff, students, alumni, corporations, government, and entrepreneurial advocates to help create a new generation of high impact entrepreneurs at Illinois Tech, an urban technical university located in Chicago. The focus of our study is the Entrepreneurship Academy Council (EA), a university-wide, academically-focused organization with an overall goal of fostering a community of entrepreneurship on campus that transcends departments and units. How might we use the tools of dynamic social network analysis to study, map, and influence the existing networks within the EA? The EA organization includes the EA Council comprised of faculty, staff, students and administrators from across the university. Specifically, the EA Council charter states that:

> The goal of the Entrepreneurship Academy Council is to help create a new generation of high impact entrepreneurs graduating from Illinois Tech. Our strategy includes (1) creating a strong entrepreneurial culture at Illinois Tech, (2) developing an infrastructure with the resources needed to support this culture, (3) developing processes through which students can achieve the dream of becoming entrepreneurs, and *(4) establishing a collaborative network with alumni, corporations, government and entrepreneurial advocates that fosters a university-based entrepreneurial ecosystem* (italics added)*.*
>
> From the Entrepreneurship Academy Council 2015/16 Annual Report

Collaborative innovation networks, or COINs, are groups of self-motivated individuals from various parts of an organization or from multiple organizations who, driven by a common vision, work together on a new idea (Gloor, et al., 2003). COINs are recognized as an essential element in fostering innovation. Powell, et al. (1996,116) referred to these "networks of learning" as the locus of innovation:

> When the knowledge base of an industry is both complex and expanding and the sources of expertise are widely dispersed, the locus of innovation will be found in networks of learning, rather than in individual firms.

In a University environment, individual colleges are analogous to individual firms that may have parties interested in collaborating on a single innovation. The colleges also have the characteristics of dispersed expertise and complex and expanding knowledge bases. An additional element is the diverse student population: at a technical University, many students have self-selected into tracks of gaining employment in, or engaging in some area of innovation. The EA was created with the intention of fostering COIN development that would facilitate connections among and between the students, faculty, alumni, administration, firms and resources for

entrepreneurs such as funding and legal assistance. Measures of EA success could include an increase in student participation in New Business Venture competitions, an increase in student start-ups, an increase in faculty/student collaborations in innovations, and an increase in utilization of the Knapp Center for Entrepreneurship. Methods of capturing these metrics will need to be coordinated and, potentially, developed.

In this preliminary study we understand RESILIENCE as the capacity to recover quickly from difficulties and adapt to discontinuous change. In the context of our study this includes:

- Engaging diverse stakeholders, including faculty, students, staff, administrators, alumni, industry, and funding entities
- Adapting to a constantly changing student body
  - That has different expectations than previous generations
  - That engages in various new technologies for the pursuit of social and professional goals
  - That learns in non-traditional ways that are less text-based and more experiential
- Adapting to rapidly changing technology
- Adapting to changes in political and policy regimes that affect enrollment and funding

We seek to discover existing collaborative innovation networks among EA Council members, mapping their internal university connections and their associations with alumni and external private and public entities. Using a mixed methods approach that includes dynamic social network analysis (SNA) tools and interviews with EA Council members we are mapping and analyzing existing networks. This will allow us to identify opportunities to enhance the social and intellectual collaborations that foster entrepreneurship and innovation within the university and among its stakeholders.

Methodology:
This research employs the use of the dynamic social network analysis (SNA) software Condor. Using Condor, we collected the meta email data (IP addresses of senders and receivers, dates of communication and responses) from the Executive Director of the EA Council, the Chairman of the EA Council, the Director of the Knapp Center of Entrepreneurship, a business school faculty of innovation, and two entrepreneurial students. The Condor analysis provided a snapshot of the total communication for "All Mail" in the email accounts associated with the university IP addresses for each subject. We then merged the datasets from the individuals in order to assess the status of the EA as a COIN. The snapshots are color-coded by domain which indicates the node type (a university constituent such as student, faculty, or staff of the university). We further identify the individual with special color coding and identify the other study subject in the set of communication. We conducted the three main Centrality calculations in Condor to map the current state of the network using the Executive Director and Chair as the primary research subjects.

Analysis:
A visual analysis shows that a substantial amount of communication by the Executive Director and Chairman of the EA is outward communication denoted by the shape and direction of the links in Condor (Appendix A). This is similar to the star-like structure, which indicates low closeness centrality and degree centrality. In other words, a network in which there are no connections between nodes, and a network structure that shows a low level of existing collaborative networks or COINs. The internal Condor calculations of betweeness confirm the visual analysis. Appendix B and C depict the visual maps of the email networks of the Director of the Knapp Center for Entrepreneurship, the faculty of Design and Innovation, and an Entrepreneurial Student. The elaborate interconnectedness and higher centrality calculations show the robustness of their networks.

Conclusions and Next Steps:
Our preliminary analysis suggests that there is significant opportunity to create a more mature and robust network within and around the EA Council. For example, we see individual subject networks that show tightly connected node clusters with high degree centrality in the network of the Director of the Knapp Center of Entrepreneurship, the entrepreneurial students, and the business school faculty member.

Based on this preliminary work our next steps include one-on-one interviews with individual subjects to discuss and interpret their network visualizations and continuing to conduct additional queries using Condor. We intend to present the network visualizations at the EA Council meeting in fall 2017 to engage members in discussions to consider ways in which they can implement their strategy by building more robust collaborative and innovative networks as indicated by more galaxy-like structures in the Condor network maps.

References:

Carlson, Carl R. and Nik Rokop. 2016. Entrepreneurship Academy Council 2015/16 Annual Report, Illinois Institute of Technology, Chicago, IL. https://web.iit.edu/entrepreneurship-academy. Accessed May 25, 2017.


Gloor, Peter A., Rob Laubacher, Scott B.C. Dynes, Yan Zhao. 2003. Visualization of Communication Patterns in Collaborative Innovation Networks: Analysis of some W3C working groups. 12th International Conference on Information and Knowledge Management (CKIM), New Orleans, LA. November 03-08, 2003.

Powell, Walter W., Kenneth W. Koput and Laurel Smith-Doerr. 1996. Interorganizational Collaboration and the Locus of Innovation: Networks of Learning in Biotechnology. *Administrative Science Quarterly*, Vol. 41, No. 1 (Mar., 1996), pp. 116-145

Appendix A:
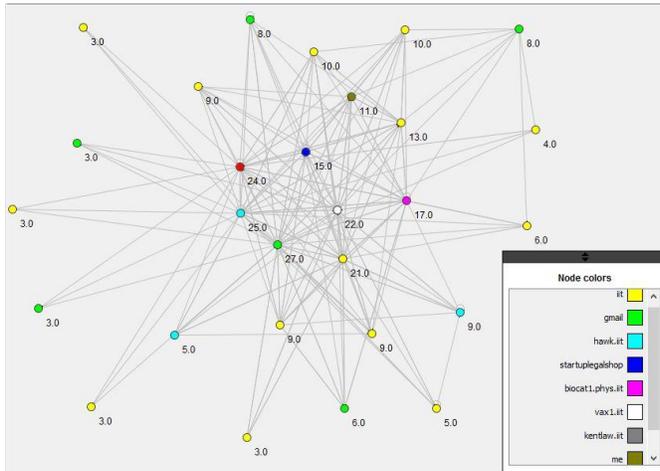
Static view of Executive Director's email to members of the Entrepreneurship Academy Council during 2016-17 academic year. Degree Centrality values range from 3.0 to 22.0. Executive Director's node is depicted in white and Degree Centrality value is 22.0. Map is color-coded by domain.
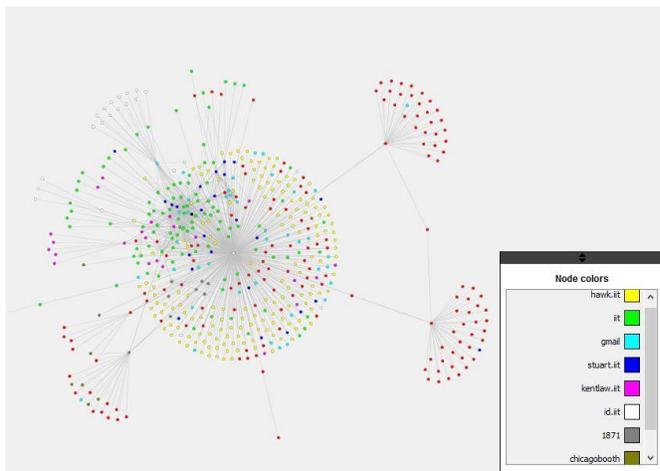

Chair of EA Council's emails to EA members. Chair's node is depicted in white at the center of the map. Map is color-coded by domain.

Note star formation of emails indicating a predominance of outward communication. A small galaxy, noted by more edges (interconnections), is depicted to the left of the Chairs' node.
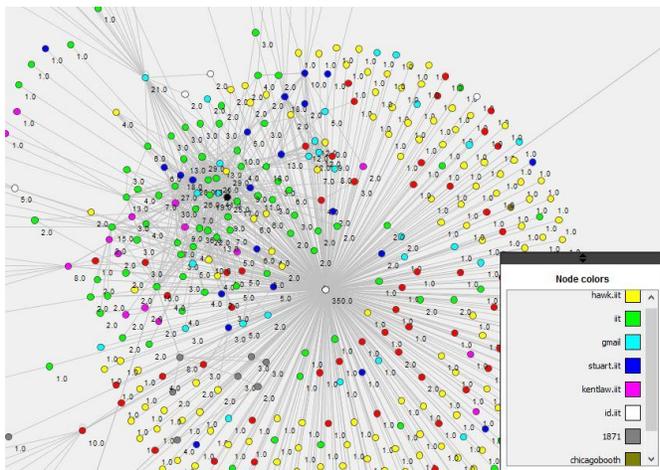

Enlargement of EA Chair's email map. Degree Centrality calculations range from 1.0 to 350.0 (Chair's figure – Chair's node in white).

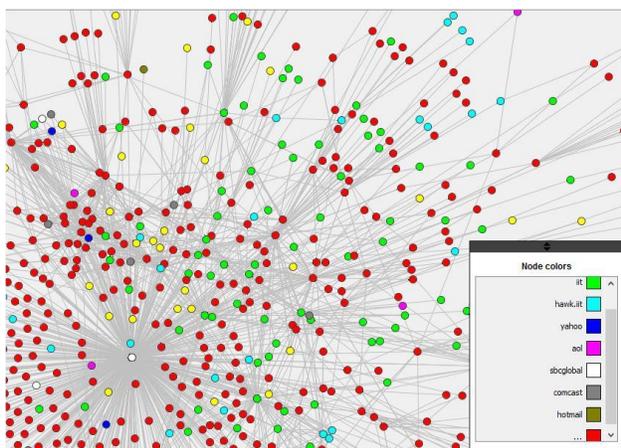Note galaxy to slight upper left of Chair's node indicating a functioning network.

Appendix B:
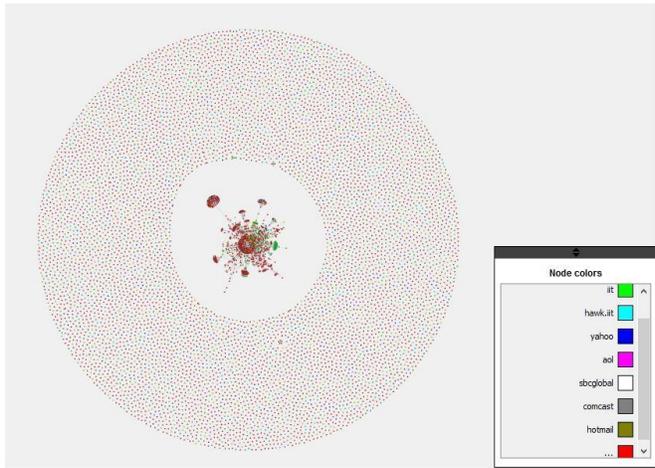
Director of Knapp Center email map. Degree Centrality calculations range from 1.0 to 398.0 (Director's figure – Director's node in white).

Note "halo" of ancillary nodes surrounding main communication network.
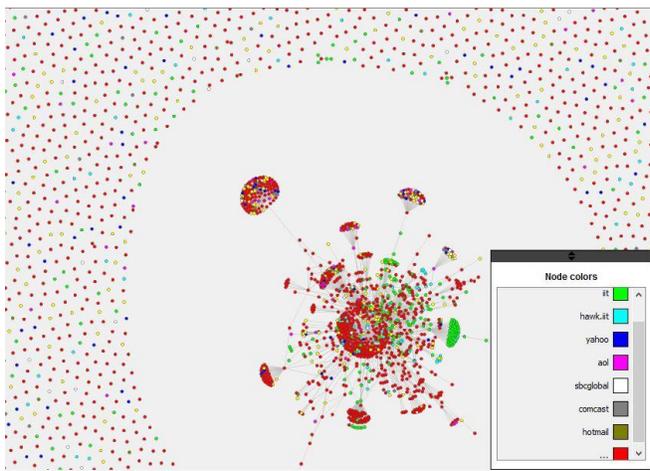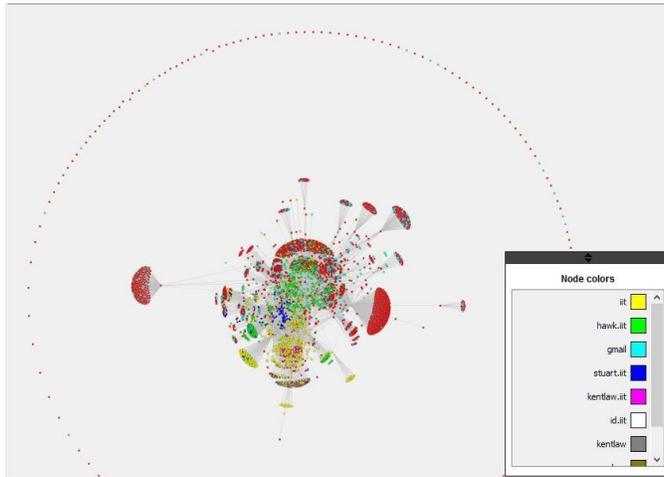

Enlargement of Director of Knapp Center's email network.
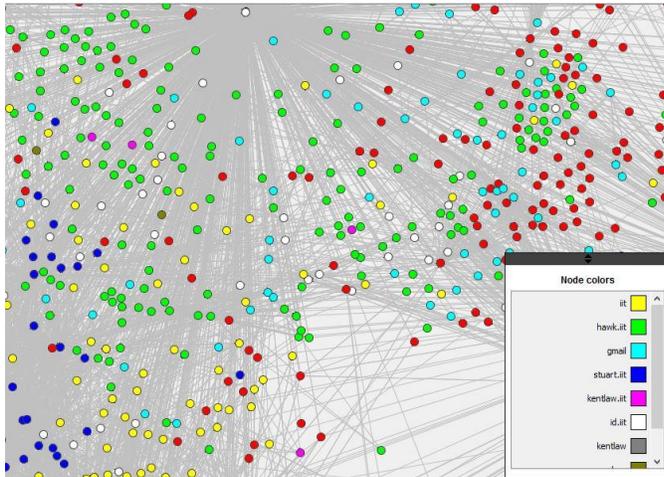

Extreme enlargement of Director of Knapp Center's email network to show higher order networked nodes.
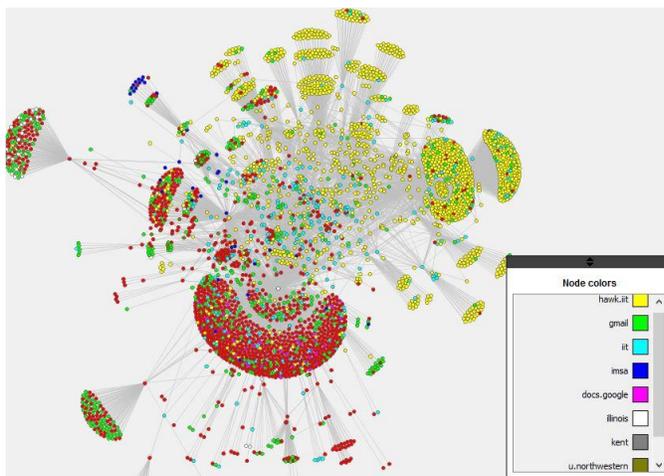
Appendix C:

Faculty of innovation email map.

Note "halo" of ancillary nodes surrounding main communication network.

Extreme enlargement of faculty's email network to show higher order networked nodes. Degree Centrality ranges from 0.0 to 1,399.0 (faculty's figure).

Entrepreneurial Student's email map. Degree Centrality figures range from 1.0 to 995.0.

Map indicates a galaxy network.