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The demands on and expectations of Institutional Research (IR) departments at colleges and universities have continued to expand over the years, yet there have been no studies on cost effective ways to develop and maintain the knowledge and skills needed by professionals in the field. Using a survey and social network analysis, this study explored the impact of participating in an Institutional Research (IR) affinity group on the development of the three tiers of organizational intelligence and the strength and nature of the social network that exists among the participants. The findings suggest that communities of practice, such as the IR affinity group, can aid the development and maintenance of some of the skills and knowledge related to the three tiers of organizational intelligence in the field of IR. The study also highlights how social network analysis can be used to explore communities of practice and approaches for professional development.

Introduction

In the past fifty years, institutional research (IR) has advanced from mere ad hoc studies conducted on the whim of administrators or faculty into a recognized profession within higher education (Reichard, 2012) that addresses student learning outcomes assessment, program review, accountability, and accreditation (Volkwein, Liu, & Woodell, 2012). Budget and resources in IR departments are often limited (Swing, Jones, & Ross, 2016), especially in small IR offices, which may consist of only one to three staff members with varying levels of experience, training, and educational backgrounds (Eimers, Ko, & Garner, 2012). In a recent national survey of IR offices, most (68%) managed budgets of less than $25,000, excluding salaries, and had limited funding for professional development (Swing, et al., 2016). The use of innovative and cost-effective approaches to supplement professional development for IR professionals could reduce the impact of IR budget constraints and provide expanded opportunities to develop and maintain the skills needed in the field. One mechanism to accomplish this is through regional special interest groups, such as an affinity group or professional learning community (Eimers, Ko, & Garner, 2012). Therefore, the focus of this study was on a state-wide Institutional Research and Planning Affinity Group (IRAG) and its role in the development of the three tiers of organizational intelligences (technical and analytical, issues, and contextual intelligences) as defined by Terenzini (1993, 2013). The affinity group in this study consisted of IR professionals appointed by their respective college presidents at 2-year public institutions from the same mid-Atlantic state.

Trying to understand such a large and complex system of interactions as represented by a state-wide affinity group is challenging. To make sense of this complex phenomenon, this study used

social network analysis to simplify the patterns and anomalies in the web of relationships at play both within and across the participating organizations (Carolan, 2014; Daly, 2010; Deal, Purinton, & Waetjen, 2009). Through the use of social network analysis, relationships within the IR community of practice were mapped out to identify the patterns and the strength of the links between its members. Network analysis is well established as an approach for examining formal and informal relationships among individuals who are members of different groups (e.g., different colleges) but who are nonetheless tied to each other, as well as information diffusion among those networks (Granovetter, 1973). This study provided unique insights into a professional development approach that was implemented at low cost to the participants and may be scalable. Furthermore, the findings suggest strategies that other institutions and systems, large and small, might explore as a complement to traditional professional development.

Background

Although IR functions differ among institutions, Saupe's (1990) widely accepted definition is useful: IR is "research conducted within an institution of higher education to provide information which supports institutional planning, policy formation and decision making" (p.1). As the IR function has expanded and become more complex, it now includes student learning outcomes assessment, program review, accountability, and accreditation (Volkwein, Liu, & Woodell, 2012). These new analytic functions and areas of expertise expected of IR professionals have been described by Volkwein, Liu, and Woodell (2012) as the "golden triangle of institutional research" (p.23). The three broad areas of expertise include: (a) institutional research and policy analysis; (b) planning, enrollment and financial management; and (c) assessment, program review, institutional effectiveness, accountability, and accreditation.

Terenzini (1993, 2013) described the knowledge and skills needed to be an effective IR professional as the three tiers of organizational intelligence: technical and analytical, issues, and contextual intelligences. The first tier includes factual knowledge, expertise in research methodology, and an understanding of computing technology and software. The second tier consists of an understanding of issues facing higher education, an extensive knowledge of one's institution and campus politics, and a strong grasp on interpersonal relationships in order to accomplish goals. The third tier is an understanding of the culture of higher education and the institution, respect for all constituents, and knowing how business is done at one's institution. In summation, Knight (2010) described an effective IR professional as one that has a "tangible impact on decision making, planning, and policy formation" (p.3).

Increased reporting demands in the face of stagnant growth of the size of IR offices will likely put even greater limitations on the IR staff's availability to perform IR functions beyond just meeting the basic state and federal reporting requirements (Swing, Jones, & Ross, 2016). In addition, the Association for Institutional Research (AIR) recently released a report on a new aspirational vision for institutional research, which expanded the definition of "decision makers" to include not only the top leadership but also added students, faculty, and staff (Swing & Ross, 2016). This shift increases both the demand and the scope of the work that the IR professional must now accomplish through more sophisticated data analytics, all of which need to be transparent, easily accessible, and student-focused.

As the demands on the IR profession have continued to expand, many IR professionals must find time to learn the skills needed on the job through informal networks or the use of listservs or online blogs and by participating in more formal regional and national professional organizations (Eimers, Ko, & Gardner, 2014). In some regions of the United States, IR professionals participate in affinity groups that are formed around shared concerns, goals, and interests based on similar occupational functions or job titles. The extant literature on affinity groups is limited, but situating them as communities of practice proved useful as a framework to inform our understanding of the affinity group in this study, a decision that was reaffirmed in our findings. The primary characteristic of communities of practice is that members collaborate with peers to continuously learn about and study their field of expertise (Putnam, Gunnings-Moton, & Sharp, 2009). Lave and Wenger (1991) listed three defining characteristics of a community of practice, which also characterize the affinity group in this research. First, its members have a shared competence in a common domain of interest. Second, the community is engaged in joint activities and discussions that help each improve the profession and share information. Finally, the members are active practitioners in their field with shared tools, resources, and methodologies to address the issues in their domain. Lave and Wenger (1991) describe these communities of practice as vehicles where the skills, knowledge, and resources can be shared among its members who actively collaborate.

Having a venue for collaboration and information sharing is important for the IR professional throughout the lifespan of his or her career. Kerrigan (2015) found a strong correlation between communication channels and the use of data to inform decision making. She suggested that this may be due to the way these lines of communication support the development of social capital "by providing avenues for sharing desirable behavior, by increasing opportunities for groups to develop and share existing knowledge, and by creating venues to share new knowledge" (p. 613). This social capital accumulates as a result of the relationships formed among the group members and can be used to influence decision-making and help obtain group cooperation, both within and across organizations, to achieve challenging objectives (Coleman, 1998; Smylie & Evans, 2006). Prior research suggests that relationships can support knowledge transfer— processes that support the movement of knowledge from a source (an individual or a unit) to a recipient (Hansen, 1999; Reagans & McEvily, 2003). Furthermore, research suggests that ties that cross functional areas or organizational boundaries may provide individuals with access to useful information and expertise not otherwise available (Coburn & Russell, 2008; Granovetter, 1973). Social network analysis is an approach to exploring these relationships (ties) that has been used extensively in educational research but not specifically in the exploration of alternatives to training and professional development opportunities.

The challenges faced in higher education require the IR professional to have the skills to discern information needs, to quickly and accurately analyze data, and to effectively communicate relevant information to inform decisions. Having a cost effective, ongoing venue to supplement the development of the skills and knowledge associated with the three tiers of organizational intelligence in IR is invaluable to the IR profession. The adeptness of the IR professional is important to the survival of institutions that rely on them to learn and adapt quickly to the changing landscape in higher education.

The IR affinity group in this research illustrates one approach to support IR professionals in their role. This particular group functions at the state level with at least one representative in the group from every community college in the state. Depending on the size of the institution, the representatives may include the senior most IR professional at an institution and one or two additional members of the IR office appointed by the president of the college. The group's purpose is to standardize methods and reporting within the state; develop best practices; exchange ideas and facilitate professional development; and review and disseminate relevant research and policy. It shares Lave and Wenger's (1991) three defining characteristics of a community of practice, discussed above.

The affinity groups are required to provide minutes for each meeting and an annual report for each affinity group is sent to the presidents' council. The agenda for the meetings is set both by the IR affinity group members (questions they have about state/federal definitions, tools used, etc.) and by the council's questions. The council often seeks the affinity group's opinion on select matters relevant to their area of expertise (i.e., common metrics to consider for establishing statewide performance funding, etc.).

Methods

This quantitative study explored the impact of participating in an IR affinity group on the development of the three tiers of organizational intelligence and the strength and nature of the social network that exists among the participants.

This paper focuses on the following questions:

1. How does an IR affinity group support the development of organizational intelligence in the IR professional?

2. To what extent does the level of experience in the field of IR influence the IR professional's perception of the IR affinity group's impact on developing and maintaining the skills and knowledge related to the three tiers of organization intelligence?

3. To what extent is an IR affinity group a community of practice that supports the development of IR capacity?

Participants

As members of the statewide IR affinity group, the IR professionals from all community colleges in the mid-Atlantic state were invited to participate in the research study. There was a total of 32 official members in the group, which included at least one representative from each college. This invitation included the heads of the IR departments and the other members of each IR departments' staff who were members of the IR affinity group during the study's timeframe of the 2015-2016 academic year. Twenty-eight respondents filled out useable surveys, yielding an 88% response rate. This was particularly important for the School Staff Social Network

Questionnaire (SSSNQ) because network maps with valid imagery of bridging and bonding requires a response rate of at least 75% (Borgatti, Caley, & Krackhart, 2006).

Data Collection

Data were collected using two internally developed instruments: the Institutional Research Advisory Group (IRAG) survey and the modified SSSNQ (Pitts & Spillane, 2009). Both were administered via Qualtrics. The absence of existing instruments to address the constructs of Terenzini's (1993, 2013) tiers of organizational intelligence or social network analysis among IR professions required the development of new instruments; further testing beyond this study is necessary to confirm the validity and reliability of the instruments.

The IRAG questionnaire is a 25-item Likert-scale survey developed to measure IR professionals' attitudes regarding the effectiveness of using the affinity group for skill building as it relates to Terenzini's (1993, 2013) three tiers of organizational intelligence. A few open-ended questions were included to collect suggestions for ways to enhance or change the IR affinity group. In addition, close ended background questions were collected, such as number of years in IR, length of time a member of the IR affinity group, the position/job title, and the individual's highest degree obtained.

IRAG Survey Reliability

Cronbach's alpha was used to determine the internal consistency and reliability of the Likert-scale survey and the sub-scale scores on the technical/analytical, issues and contextual intelligence tiers. The internal consistency and reliability of the IRAG survey and sub-scales was pilot tested on a group of former IR affinity group members ($n = 11$) and with the current group of IR affinity group members ($n = 28$). The three subscales of the IRAG appeared to have good internal consistency, with Cronbach's alpha of over .80 on both the pilot sample of former IR affinity group members and in the sample of current IR affinity group members (see Table 1). All items appeared to be worthy of retention.

Table 1
Reliability Statistics for Subscales of IRAG Survey

Subscale	Number of Items	Pilot Study Cronbach's alpha	Current Study Cronbach's alpha
Technical/Analytical Tier	9	.952	.869
Issues Tier	9	.936	.838
Contextual Tier	9	.933	.911

The SSSNQ, is an instrument designed to study school leadership practice and advice networks within the K-12 setting (Pitts & Spillane, 2009), but it has not been previously used in higher education. In the current study, the SSSNQ survey was modified, with permission from the authors, to measure the nature and the strength of the relationships in the IR affinity group network, and was adapted to examine the level of development related to the three tiers of

organizational intelligence. Questions on the modified SSSNQ asked respondents to indicate the frequency and importance of the interaction with each member of the IR affinity group both on the receiving and giving end of the information exchange. Basic demographic and social constructs such as job classification and length of time spent in IR were also collected on each participant. The modified instrument was pilot tested with a small group of experienced IR professionals prior to its use in this study.

The study used a whole network design in which all members of a group were included in the network, enabled by the well-defined boundaries of the IR affinity group's official membership list. The sociocentric approach allowed the network connectivity to be examined in order to draw conclusions about the entire network because every member of the IR affinity group was invited to participate and all members were identified by name and organization on the modified SSSNQ (Robins, 2015). The network boundaries were set using nominalist strategies (Heath, Fuller, & Johnston, 2009); in other words, the boundaries were defined by the researcher. The IR affinity group is comprised of individuals who are approved by their college president to be a member of the group. The official IR affinity group's membership list was used to create the name interpreters on the modified SSSNQ[1] to determine the nature and strength of the ties among the members of the network (Heath, Fuller, & Johnston, 2009).

Data Analysis

IRAG survey. The IRAG data was analyzed using SPSS 24. Cronbach's alpha was used to determine the internal consistency and reliability of the Likert-scale survey and the sub-scale scores (Cortina, 1993) on the technical/analytical, issues, and contextual intelligence tiers. Descriptive statistics on the three subscales were calculated and the mean scores were compared for the entire group to capture perceptions about IR affinity group participation and skill development among the tiers to answer the first research question (Cohen & Lea, 2004; Elliott & Woodward, 2007; Fink, 1995).

To answer the second research question, nonparametric tests to assess for group differences were used due to the small sample size of the population. A Kruskal-Wallis test was used to compare the sub-scale scores and the overall score on the IRAG survey among the three groups based on the length of time the participant was a member of the IR affinity group (Cohen & Lea, 2004; Elliott & Woodward, 2007; Fink, 1995). Finally, a Spearman's rho test was used to determine if there was a correlation between the scores on the IRAG survey and the number of years of experience in the field of IR (Cohen & Lea, 2004; Elliott & Woodward, 2007; Fink, 1995).

Modified SSSNQ. To answer the third and final research question, the modified SSSNQ data were analyzed using Node XL to determine the nature and strength of the relationships among the participants in the IR affinity group. The use of sociocentric network analysis captured the channels of communication that exist among the members of the IR affinity group. Using a

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[1] Name generators compile the list of those in the group (for example, John Smith (Rowan University, IR Affinity Group Chair) or Jane Doe (Rowan University Math Coach). Name interpreters generate information on the nature of the ties between network members; they are there to help identify people, to make it easier for the person completing the SSSNQ to recall the interaction he or she had with each person from the group.

social network map created a visual representation of the nodes that represent the members of the IR affinity group within the network and the strength and number of connections each has to one another (Daly, 2010; Deal, Purinton, & Waetjen, 2009). The ability to create visual representations of the number and strength of the ties among the participants of the IR affinity group network helped determine to what degree the group acts as an active and mature community of practice.

Walker, Wasserman, and Wellman (1994) described an active and intimate network as one where the density ranges between 0.30 and 0.50. Density is the ratio of ties in a network to the total number of ties possible (Borgatti, Everett, & Johnson, 2013). By measuring the network density, it was possible to quantify the frequency of interaction and its importance to the IR affinity group members as a mechanism for the development of the three tiers of organizational intelligence. Determining the degrees helped identify those members of the IRAG who are the most connected members (star nodes) or who connect subgroups together (bridges). The stars are the highly connected members who can be considered "opinion makers" and have a strong influence in the group (Deal, Purinton, & Waetjen, 2009), while bridges play an important role in facilitating the exchange and flow of information on all three tiers of organizational intelligence. These individuals are sometimes seen as "gatekeepers" and can play a role in adopting change initiatives (Deal et al., 2009).

The strength of the ties among the participants is measured by the frequency of interaction. The greater the frequency, the more connected and therefore the greater potential for the exchange of information. By measuring the network density, it was possible to quantify the frequency of interaction and its importance to the IR affinity group members as a mechanism for the development of the three tiers of organizational intelligence. This provided a sense of collaboration within the network and tie strength provided further insight into access to resources and opportunities for information dissemination within subgroups. Determining the degrees helped identify those members of the group who are key players within the network.

Other measures of network cohesion include betweenness centrality, closeness centrality, and eigenvector centrality. Betweenness centrality indicates how important a node is at connecting or "bridging" different parts of the network. Closeness centrality is a measure of how close each node is, on average, to the other nodes in the network, and therefore how fast a given node in a network can reach other nodes (Yang, Keller, & Zheng, 2017).[2] Eigenvector centrality gives an indication of how well connected a particular member is to other well-connected members (Borgatti, Everett, & Johnson, 2013; Hansen, Shneiderman, & Smith, 2011).[3]

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[2] Closeness centrality gives an indication of how quickly a node or member of the group can exchange information/knowledge with others, for example, by communicating directly or through the shortest route. For example, node A is directly connected to node B. Node B is directly connected to Node A and Node C. Node A is indirectly connected to Node C through Node B. So B has more direct connections and has a higher measure of closeness centrality.

[3] Eigenvector centrality provides a measure of how well connected a node or member is to other "popular" or well-connected members of the group (Hansen, Shneiderman, & Smith, 2011). For example, if Node B is a star node, with many direct connections to other members, and Node A is connected to Node B, Node A has a higher Eigenvector centrality than Node C, who is not connected to Node B. As a result, Node C cannot utilize Node B influence and information the way Node A can.

Findings

Analysis of IRAG Survey

The overall subscale scores for the three tiers (which are aligned with Terenzini's (1993, 2013) three tiers of organizational intelligences) indicate that the IR affinity group members believed that participation in the group helped them develop or maintain related knowledge and skills as well as transfer some of these skills and knowledge within a specific tier. Specifically, in the technical/analytical tier, over 90% of respondents indicated that participation in the affinity group helped a moderate to great amount in their understanding of the definitions of reporting elements required for the state and federal IPEDS data files, but had little to no impact on their understanding of intermediate to advanced statistical analysis techniques. In the issues tier, 93% of respondents reported participation in the IRAG helped at least a moderate amount to a great deal to keep them aware of and understand pending state legislation that could impact community colleges. In contrast, less than half (46%) reported that participation in the IRAG helped them understand techniques for working with others to accomplish their IR goals. Within the contextual tier, 68% of respondents indicated that participation aided in their understanding of external environment that impacted higher education, but only 36% reported participation was helpful with understanding how to work with stakeholders and navigating their internal environment.

Analysis of IRAG Subscales by Length of Membership in IR Affinity Group

To understand the influence of the IRAG longevity on participants' perceptions of the IRAG, the Kruskal-Wallis test was used to compare the sub-scale scores and the overall score on the IRAG survey among the three groups based on the length of time the participant was a member of the IR affinity group. Results of that analysis indicated that the groups did not differ significantly on the technical and analytical and the contextual tiers; however, there was a statistically significant difference on the issues tier subscale ($H(2) = 7.189$, $p < .05$) with a mean rank of 8.25 for those who were members of the IR affinity group for one year or less, 11.56 for those who were members two to five years, and 17.95 for those who were members for more than five years (see Table 2).

A post hoc rank sums test indicated that the IR professionals who were members for one year or less rated the impact of participating in the affinity group on the issues intelligence tier significantly lower than those IR professionals who were members for more than five years, $z = -9.705$, $p < .05$. However, IR professionals who were members for two to five years did not differ significantly from those IR professionals who were members for one year or less, $z = -3.306$, $p < .05$, or those who were members more than five years, $z = -6.399$, $p < .05$.

Table 2
Score on Subscales by Length of Time in the IR Affinity Group

		n	Mean Rank
Technical/Analytical Tier	One Year or less	7	12.71
	2 to 5 Years	10	14.45
	More than 5 years	11	15.68
Issues Tier	One Year or less	6	8.25
	2 to 5 Years	9	11.56
	More than 5 years	11	17.95
Contextual Tier	One Year or less	7	11.29
	2 to 5 Years	9	13.67
	More than 5 years	11	16.00
Total IRAG Score	One Year or less	6	8.33
	2 to 5 Years	8	12.00
	More than 5 years	11	16.27

Effectiveness of the IR Affinity Group as Vehicle for Professional Development

In addition to the difference on the issues subscale, the longer-time members rated the statement, "the relationships I have developed with the other IR affinity group members have assisted in developing or maintaining the skills and knowledge I need to be successful in IR" higher than those who were only members for a year or less. There was a statistically significant difference on the relationship question ($H(2) = 10.427$, $p < .005$) with a mean rank of 6.93 for those who were members of the IR affinity group for one year or less, 16.55 for those who were members two to five years, and 17.45 for those who were members for more than five years (see Table 3). The greatest difference was observed between those who were members of the IR affinity group for only a year or less and those who reported being members for more than five years. There was no significant difference between those who were members two to five years compared to those who had been members for more than five years.

There was no statistical difference between the three groups based on length of membership for the other items related to the effectiveness of the IR affinity group in helping to develop or maintain the skills and knowledge needed to be successful in IR, and all three groups believed that participating in IR affinity group helped them improve their skills and knowledge needed as an IR professional.

Table 3
Score on Effectiveness of IR Affinity Group by Length of Membership

	Membership Group	*n*	Mean Rank
The current structure of the IR affinity group provides an opportunity for me to develop the skills and knowledge needed to be successful in IR.	One Year or less	7	13.07
	2 to 5 Years	10	16.85
	More than 5 years	11	13.27
Participating in the IR affinity group has helped improve my skills and knowledge as an IR professional.	One Year or less	7	8.93
	2 to 5 Years	10	17.70
	More than 5 years	11	15.14
I would like to see changes made to the IR affinity group to enhance professional development opportunities.	One Year or less	7	10.86
	2 to 5 Years	10	14.85
	More than 5 years	11	16.50
The relationships I have developed with the other IR affinity group members have assisted me in developing or maintaining the skills and knowledge I need to be successful in IR.	One Year or less	7	6.93
	2 to 5 Years	10	16.55
	More than 5 years	11	17.45

Relationship between experience and perceptions of the IRAG

Finally, to understand how the level of experience in the field of IR influences the IR professional's perception of the IR affinity group, a Spearman's rho test was used to determine if there is a correlation between the subscales scores on the IRAG survey and the number of years of experience in the field of IR. There was a nonsignificant correlation of $r_s = 0.02$ $(n = 25, p = ns)$ between the IRAG total score and the number of years of experience in the field of IR. The IRAG subscales for technical and analytical $(r_s = -0.28, n = 28)$, issues $(r_s = 0.20, n = 27)$ and contextual $(r_s = -0.10, n = 26)$ also were nonsignificant. Therefore, there was no significant difference in the IR professional's perception of the IR affinity group based on the number of years of experience in IR.

Social Network Analysis

The analysis of the modified SSSNQ determined the nature and strength of the relationships among the participants in the IR affinity group in order to explore the degree to which the group is an active community of practice.

Descriptive statistics on the network. There was a total of 32 nodes in the IR affinity group with an overall graph density of 0.31 and an average degree of 13, suggesting that an active network exists among the members creating a conduit for the flow of information to and from the participants.

Figure 1 shows the ties between IR affinity group members with a triangle representing individuals who were members for a year or less, a circle representing members between two to

five years, and a solid square representing those who have been a member of the IR affinity group for more than five years. As Figure 1 shows, individuals who are members longer tended to have a higher number of connections to others within the group as compared to the nodes or individuals on the right-hand side, representing individuals who have been a member for less time that have fewer connections to other members of the IRAG.
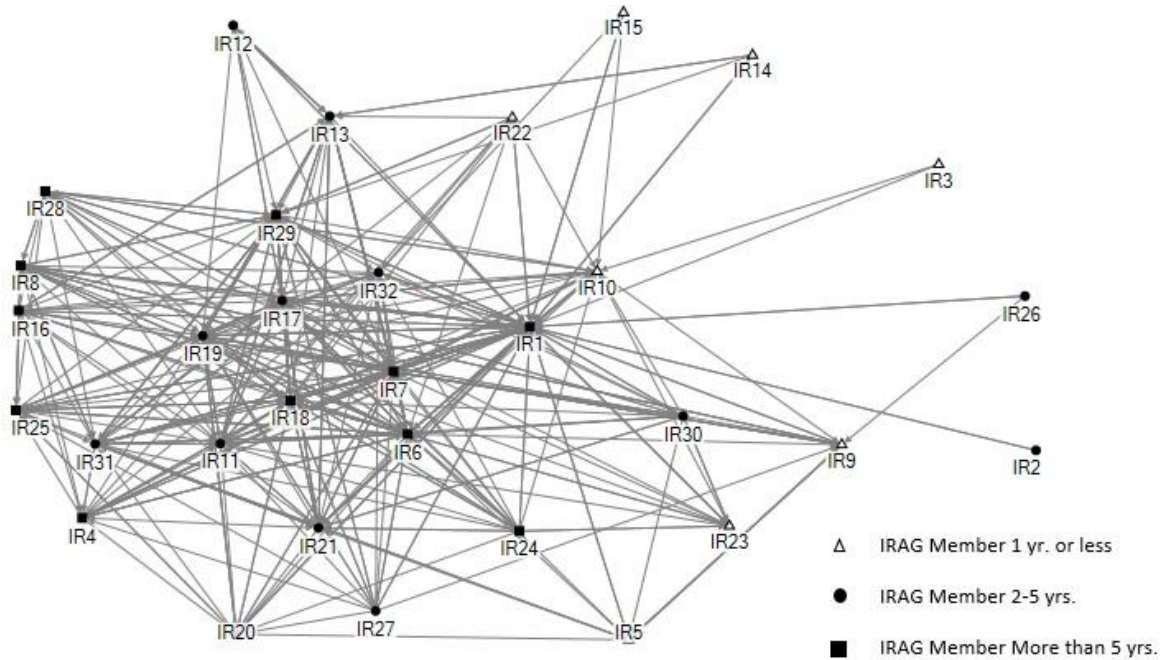

Figure 1. IRAG Network Diagram

When comparing the three network diagrams (Figures 2, 3, and 4) depicting different tiers of organizational intelligence, a pattern of decreasing density and in and out-degree connections emerges. The in-degree metric represents the number of edges or connections that point toward a node, in this case the number of people in the group who seek advice or information from a particular IRAG member; this is represented by a line with an arrow pointing to the node. In other words, the arrow points to the IRAG member who is the information giver. The out-degree metric represents the number of edges or connections that point away from a node, in this case the number of people in the group whom the IRAG member seeks advice or information from. A line with an arrow on both ends represents a connection between two nodes where there was a reciprocal exchange of information seeking and giving. Table 4 contains the network density and in-degree and out-degree for the overall network and by each tier of organizational intelligence. The highest level of connection occurs in the technical and analytical exchange with the issues and contextual tiers showing fewer and less dense connections among the members of the IR affinity group.

Table 4
Measures of Network Density and Degrees for the IR Affinity Group

	Density	Average In-Degree	Median In-Degree	Average Out-Degree	Median Out-Degree
Overall	0.31	9.63	8.50	9.63	11.00
Technical/Analytical	0.23	7.16	7.50	7.16	6.00
Issues	0.14	4.29	3.00	4.29	3.00
Contextual	0.09	2.79	2.00	2.79	0.00

In contrast to the overall network diagram (see Figure 1) where every node was connected to at least one other node, the separate diagrams of the technical (see Figure 2), issues (see Figure 3), and contextual (see Figure 4) tiers show a decreasing number of connections and an increasing number of isolated group members.

The technical and analytical network diagram (Figure 2) has fewer isolated members and a higher number of connected links compared to the issues (Figures 2) and contextual tier networks (Figure 3). The higher the number of links, the more connected a group member is to other members of the group. These individuals have one or more members that they go to in order to get advice or information regarding topics related to the three tiers of organizational intelligence. In this case, more members are connected to one another relating to questions or information sharing in the technical and analytical tier than at the issues and contextual tier.

The isolated nodes, the triangles and dots with no lines connecting them to the other members, represent members with no connection to another member. This isolation often involves nodes representing newer members of the group as seen in Figures 2 through 4. Based on these diagrams, it appears that new members report having fewer members within the group that they go to when they have questions about topics related to the three tiers of organizational intelligence.
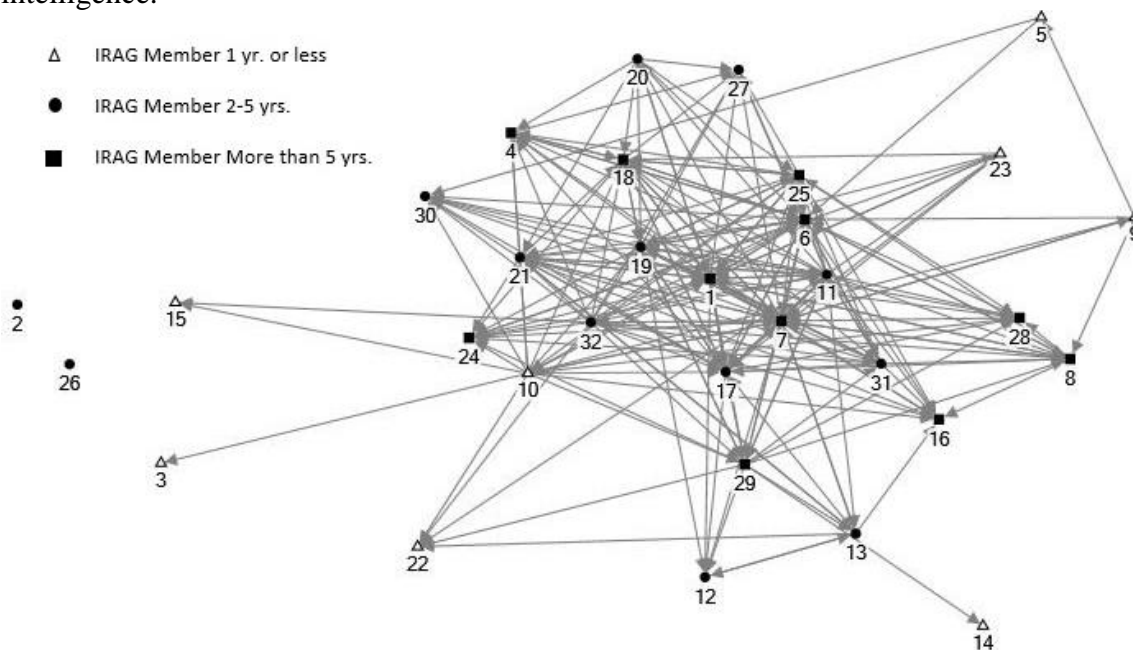

Figure 2. Technical and Analytical Skills and Knowledge Exchange Network
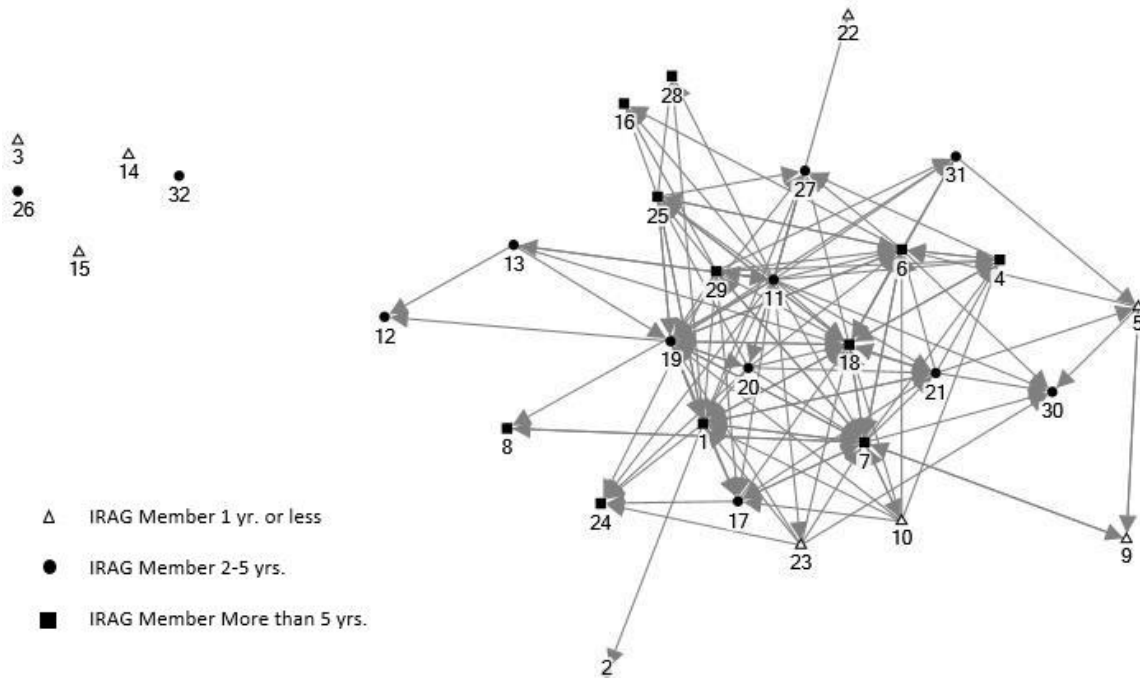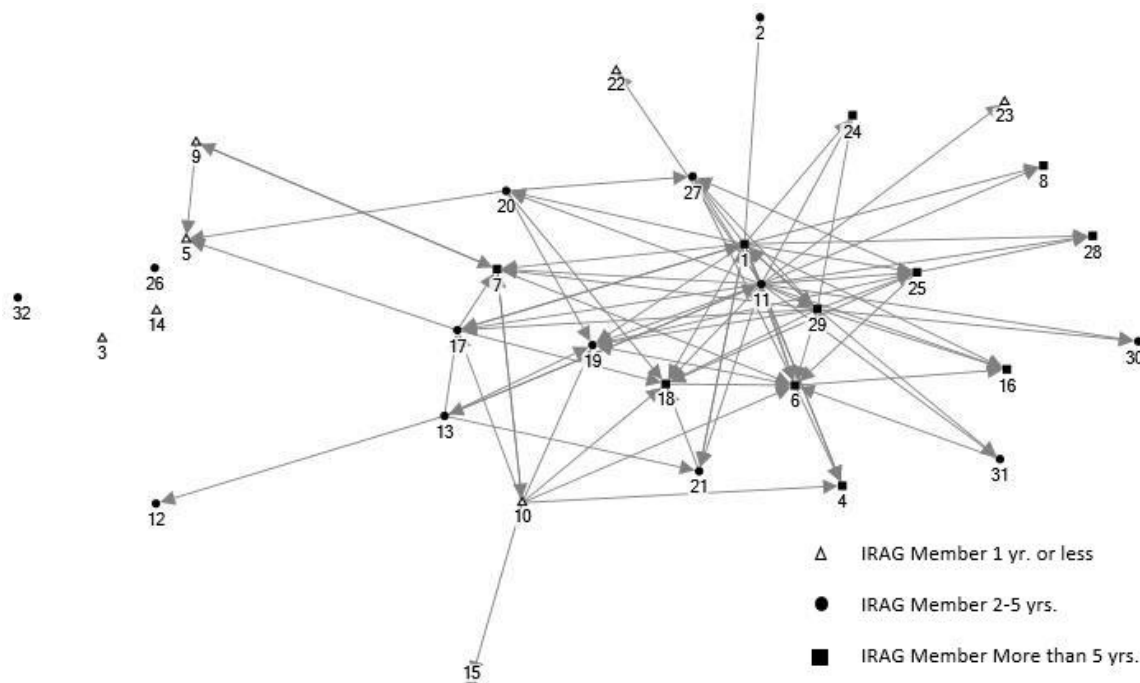
Figure 3. Issue Skills and Knowledge Exchange Network

Figure 4. Contextual Skills and Knowledge Exchange Network

Network cohesion. Finally, network cohesion was examined to measure the density of the relations or ties between actors. Network cohesion is measured by network centrality metrics that provide a means to quantify how important a node (in this case, an IRAG member) is within the network (Hansen, Shneiderman, & Smith, 2011).

Similar to the previous findings, Table 5 shows the measure of network centrality for the tiers of organizational intelligence vary slightly on the betweenness centrality, with the contextual tier having the highest average since some nodes have a more important role than others in connecting members and in the flow of information to other nodes. This means that some members of the group are relied on more frequently as a source of information and play a greater role in connecting members of the group to each other.

Table 5
Measures of Network Centrality

	Betweenness	Closeness	Eigenvector
Overall	16.56	0.022	0.031
Technical/Analytical	17.63	0.020	0.031
Issues	17.06	0.019	0.031
Contextual	24.31	0.017	0.027

It should also be noted that although there are fewer connections in each tier, there is still a core of group members that emerge in each tier. The measures of centrality for the individual nodes are shown in Table 6, sorted by the most connected members to the least. As with previous findings, the nodes most connected more likely represented those individuals who were members of the IR affinity group for a longer period of time. This analysis shows that with this particular IR affinity group, the longer an individual is a member, the more likely they are to be a "star" node or "bridge" node as indicated by higher betweenness and eigenvector centrality measures shown in Table 6.

When dividing the participants in half after ranking them on the basis of their connectedness, clear patterns became evident (see Table 6). Among those in the top half (those most connected), only one individual (3%) had been an IRAG member for a year or less and 50% of the participants had been members for more than five years. In contrast, 50% of those in the bottom half had been members or a year or less and only 31% had been members for more than five years.

Table 6
Measure of Centrality for Individual Nodes in IR Affinity Group

Node	Degree	In- Degree	Out-Degree	Betweenness Centrality	Closeness Centrality	Eigenvector Centrality	IRAG Member
IR1	29	31	15	237.463	0.032	0.053	> 5 Years
IR7	24	22	18	27.676	0.026	0.049	> 5 Years
IR17	23	19	13	21.229	0.025	0.046	2-5 Years
IR6	23	17	18	25.570	0.026	0.049	> 5 Years
IR11	22	21	11	16.267	0.025	0.047	2-5 Years
IR29	22	20	9	32.118	0.025	0.045	> 5 Years
IR19	20	19	14	18.886	0.025	0.046	2-5 Years
IR10	19	17	6	40.332	0.023	0.037	1 Year <
IR32	19	19	3	19.084	0.023	0.041	2-5 Years
IR21	18	13	12	8.321	0.023	0.040	2-5 Years
IR25	18	13	11	4.345	0.023	0.042	> 5 Years
IR31	18	18	11	10.674	0.023	0.042	2-5 Years
IR18	17	21	16	17.479	0.026	0.049	> 5 Years
IR24	14	0	14	2.799	0.021	0.033	> 5 Years
IR4	14	7	13	3.205	0.022	0.037	> 5 Years
IR20	13	11	7	3.657	0.020	0.030	2-5 Years
IR16	12	0	17	2.930	0.022	0.040	> 5 Years
IR30	12	0	14	6.783	0.021	0.031	2-5 Years
IR8	12	9	13	4.135	0.021	0.035	> 5 Years
IR13	11	10	9	10.664	0.020	0.028	2-5 Years
IR27	11	0	12	3.064	0.020	0.028	> 5 Years
IR28	11	2	12	0.435	0.020	0.032	> 5 Years
IR23	9	7	4	0.292	0.019	0.022	1 Year <
IR5	8	3	6	2.018	0.019	0.017	1 Year <
IR12	6	1	6	0.000	0.018	0.015	2-5 Years
IR22	6	0	9	0.965	0.019	0.022	1 Year <
IR9	6	8	4	9.476	0.019	0.017	1 Year <
IR14	3	0	3	0.000	0.017	0.007	1 Year <
IR15	3	0	3	0.133	0.017	0.007	1 Year <
IR2	1	0	1	0.000	0.016	0.003	1 Year <
IR26	1	0	2	0.000	0.017	0.004	> 5 Years
IR3	1	0	2	0.000	0.017	0.005	1 Year <

Discussion

This research addressed the numerous challenges faced by IR offices (see Calderon & Mathies, 2013; Swing, Jones, & Ross, 2016) by investigating the use of a community of practice as a mechanism to build research capacity in the three tiers of organizational intelligence in the IR professional. Previous researchers have established the potential of professional communities for

developing organizational capacity to learn and grow (Garet et al., 2001; Haviland & Rodriguez-Kiino, 2009; King & Bouchard, 2011; Penuel et al., 2007), but have not yet applied this concept to the IR profession.

IR Affinity Group and Development of Organizational Intelligence

Overall, the analysis of the IRAG survey results showed that participants indicated that the IR affinity group helped to develop and maintain some of the skills and knowledge associated with the three tiers of organizational intelligence in the IR professional. An item by item analysis of each of the questions related to the three tiers also revealed that some skills and knowledge sets within a specific tier were impacted less than others.

The study participants indicated that it helped them to gain a better understanding of external demands, such as knowledge of required federal and state reporting data element definitions, external legislation, and issues impacting higher education outside of their own institutions. However, the group as a whole indicated that participation in the IR affinity group had less of an impact on their knowledge and skills related to working with internal stakeholders and understanding the internal workings within one's institution.

According to Terenzini (1993), although technical and analytical intelligence is foundational to an IR professional, it has little value or usefulness without the remaining two levels of intelligence to give it meaning and purpose. Given the importance of issues and contextual intelligence, the lack of impact on the knowledge and skills related to internal dynamics reported by the IRAG members suggests there is a need to enhance the current IR affinity group or to supplement the IR professional's acquisition of these skills in other ways. Both Knight (2014) and Eimers et al. (2012) contend that these skills are essential for the IR professional to advance to leadership positions and to have a meaningful and positive impact on one's institution.

Perception of IR Affinity Group by Level of Experience in IR

The IRAG survey included four items designed to measure the effectiveness of the IR affinity group by length of membership. These results indicated that for the statement "the relationships I have developed with other IR professionals have assisted in developing or maintaining the skills and knowledge I need to be successful in IR," there was a statistically significant difference between responses of members with one year or less in the IR affinity group and the responses of those who were members for five years or more.

Although the length of experience in IR did not have an influence on the members' perception of the IR affinity group, the length of time as a member of the group was important. The respondents who were members for more than five years were more likely to perceive value in the relationships formed with other IR affinity group members than those who were members for one year or less. This result is not surprising since it takes time to build the rapport and trust with other members. But in light of these findings, it may be helpful to connect new members with an experienced member to help expedite a sense of belonging and understanding for the newcomer (Wenger, 1998). This pairing of an experienced IR affinity group member with a new IR affinity group member could help eliminate the possibility of cliques or clusters forming within the

group, which can prevent new and existing members from benefiting through the exchange of information (Deal, Purinton, & Waetjen, 2009; Wenger, 1998; Wenger, McDermott, & Snyder, 2002).

Social Network Analysis of the IR Affinity Group

The social network analysis revealed that the most connected people in the network were those who were members more than five years. Having long-term members who hold the historical antecedents and group history, who are actively engaged, and who are connected is important to the success and longevity of the group (Wenger, 1998; Wenger, McDermott, & Snyder, 2002). These findings support the role of a community of practice in capacity building efforts and leadership development.

The social network analysis also showed there was a higher level of connection in the technical and analytical tier than in the issues and contextual tiers. The issues and contextual tiers likely consist of potentially sensitive items such as workplace politics and navigating sensitive topics related to state and federal policy, which may better suited to a smaller, more intimate network of highly trusted colleagues. This may represent a subset of the larger IR affinity group or a completely separate group formed outside of the IRAG. Further research is needed to determine if the size of the network and level of trust in the group have any impact on developing the skills and knowledge related to the more potential sensitive items of organizational intelligence in the IR professional.

This study highlights how social network analysis can be used to identify the stars and bridges in a community of practice quickly and with little cost. This has implications for where information and knowledge sharing might be targeted in order to improve dissemination. As Granovetter (1973) suggested, weak ties can connect members of different groups and thereby provide access to different information. While strong ties support information flow, weak ties serve as the bridges that span groups (Granovetter, 1983). Equally important, the network analyses revealed inequalities in the effectiveness of the communities of practice among the three tiers and can be used as a tool to identify the strengths and weaknesses in a group. This knowledge can be used to enhance communities of practice or to identify areas where members may need to supplement their activities to acquire these knowledge and skills through other mechanisms.

Since this study was unable to determine if the size of the IR office had any impact on the IR professional's perception of the benefits of being a member of the IR affinity group, this is also worth exploring given the numerous small IR offices among higher education institutions (Morest & Jenkins, 2007; Volkwein, Liu, & Woodell, 2012). It is possible that a smaller IR office may value the additional resources more than a larger IR office. A recent study by Swing, Jones, and Ross (2016) indicated that many IR offices are small compared to other administrative offices, so future studies could examine if there is a relationship between the perceived benefits of belonging to an IR affinity group and the size of the IR office.

Finally, the expanded definition of "decision makers" to include not only the top leadership but also students, faculty, and staff (Swing & Ross, 2016) adds new demands on the IR professional.

Future studies can examine the impact of professional development on this shift in the demand and the scope of the work that the IR professional must now accomplish.

Limitations

This study was limited to one affinity group within a specific geographic region and a single institution type, which may impact its applicability to other contexts such as other affinity groups outside of the IR profession and community college sector. The design of the affinity group, given the sponsorship of its members by college presidents, is also unique, and groups that develop organically or are ad hoc may have very different experiences. This study is unable to address the role that such implicit presidential support plays in its effectiveness.

In addition, several studies have noted the limitations inherent to communities of practice, including issues of power and trust, size, and self-selection of membership, which need to be taken into consideration when examining this approach (Kerno, 2008; Pemberton, & Mavin, 2007; Roberts, 2006; Wenger et al., 2002). Although Lave and Wenger's original work described communities of practice as spontaneous and self-organizing, later applications have demonstrated they can be implemented via organizational design (Wenger et al., 2002). This is the case with the affinity group in this study, where the issues surrounding self-selection were mitigated by having the presidents of the respective institutions appoint members to the group. However, future research needs to explore these limits in relation to the effectiveness of this strategy as a vehicle for professional development.

Finally, the quantitative design of this study limits the depth of exploration into the way in which social interactions impact professional development. Although the survey in this study included several open ended questions to validate the quantitative results, future qualitative studies can provide a deeper understanding of how the social interactions amongst the participants did or did not contribute to the professional development of the IR professional. Despite these limitations, the results of this study shed light on the utility of a community of practice in the development of the three tiers of organizational intelligence in the IR professional which warrants further study.

Conclusion

In a time when higher education is facing unprecedented challenges including decreased state and federal funding and increased public scrutiny, colleges and universities are forced to reexamine current practices and find ways to streamline academic programs and operate more efficiently with fewer resources. The highest level of professional excellence from institutional researchers is needed to provide guidance to educational leaders as they respond to the challenges with less support from public funds and resources.

The challenges facing higher education, together with the increasing importance of the role of IR professionals require colleges to adequately staff the IR office with qualified personnel who possess competence with research methods, knowledge of pertinent issues, and an ability to work within and across institutional boundaries to inform decision-making, policy formation and strategic planning. Additionally, venues are needed to support the development of training materials for new and returning IR professionals to provide a standardized foundation of

terminology and methods for the field. Leveraging the social networks that exist in professional communities is a best practice for IR offices to strengthen capacity and support ongoing professional development that can be implemented at low cost. By rethinking approaches to capacity building for institutional research, it is possible to meet the demand for good quality data and analysis that will inform decision-making processes and ensure a greater level of accountability and effectiveness within postsecondary education.

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Appendix

IR Affinity Group Survey

1. What is the highest level of education you have completed?
   - 2-year College Degree
   - 4-year College Degree
   - Master's Degree
   - Doctoral Degree
   - Professional Degree (JD, MD)

2. How many year(s) of experience do you have in the field of institutional research (IR)?

3. How long have you been a member of the IR affinity group?
   - One Year or less
   - 2 to 5 Years
   - More than 5 years

4. Select the one that best describes your primary role in your IR office:
   - Head of IR department
   - Analyst
   - Research or Technical Assistant
   - Programmer
   - Other (please specify primary role)

5. Size of IR office: Including yourself, how many people work in your institution's IR office? _____

Technical & Analytical Skills: Each item below describes an expectation about your experience as a member of the IR affinity group. Please tell us how much your participation in the IR affinity group has helped you to develop or maintain the knowledge and skills related to the field of IR and then indicate how important each item is to your ongoing professional development in the field of IR.

***In the online survey administered to participants, the items listed below were formatted with the following response options. Participants responded to both.**

Participating in the IR affinity group has helped in my:				
A great deal	A lot	A moderate amount	A little	None at all

How IMPORTANT are each of the following items?			
Very important	Somewhat important	Somewhat unimportant	Very unimportant

Understanding of data elements required for NJ SURE reporting.

Understanding of data elements required for IPEDs or other federal reporting.

Understanding of research study design and methodology.

Basic knowledge of survey tools such as Survey Monkey, Qualtrics, or Google Forms.

Basic knowledge in the use of statistical applications such as SPSS, SAS, or Excel.

Intermediate to advanced knowledge in the use of statistical applications such as SPSS, SAS, or Excel.

Knowledge of advanced statistical techniques such as enrollment projections, regression analysis, ANOVA, etc.

Knowledge of techniques or tools to extract data from your ERP system such as Datatel/Ellucian, Banner, Jenzebar, etc.

Knowledge of business intelligence tools related to strategic planning & decision making such as dashboards, data warehouses, data mining, etc.

Issues in Higher Education: Each item below describes an expectation about your experience as a member of the IR affinity group. Please tell us how much your participation in the IR affinity group has helped you to develop or maintain the knowledge and skills related to the field of IR and then indicate how important each item is to your ongoing professional development in the field of IR.

Awareness of proposed or pending legislation in the State of NJ impacting the community college sector.

Awareness of proposed or pending federal legislation impacting the community college sector.

Understanding of proposed or pending legislation in the State of NJ impacting community colleges.

Understanding or proposed or pending federal legislation impacting community colleges.

Understanding of key management issues for community colleges in NJ such as enrollment management, instructional cost, and academic program prioritization, etc.

Understanding of key issues related to strategic planning.

Understanding of key issues related to institutional effectiveness of accreditation.

Understanding how decisions are made, formally and informally at a community college.

Understanding of techniques for working with and through others to accomplish goals at my institution.

Contextual Issues: Each item below describes an expectation about your experience as a member of the IR affinity group. Please tell us how much your participation in the IR affinity group has helped you to develop or maintain the knowledge and skills related to the field of IR and then indicate how important each item is to your ongoing professional development in the field of IR.

Knowledge of key institutional processes that impact decision-making at a community college.

Ability to have a positive influence or impact on decision making at my institution.

Understanding of strategies for navigating the political arena at my institution.

Knowledge of how to identify key players at my institution.

Understanding of the culture and history of community colleges in NJ.

Knowledge of the internal environment in which my institution operates.

Understanding of techniques for working with both internal and external constituencies groups such as the Board of Trustees, community members, or state or national advocacy groups, etc.

Understanding of techniques for managing expectations of IR from different constituency group such as administrators, faculty, staff, or Board of Trustees, etc.

Rate how much participating in the IR affinity group has helped you in the following areas:

A great deal	A lot	A moderate amount	A little	None at all

Gain an understanding of technical and analytical issues such as reporting data elements, use of statistical software, or other IR related technical or analytical questions.

Gain an understanding of the issues impacting community colleges such as state and federal legislation, strategic planning, or program prioritization.

Gain an understanding of the issues related to internal constituents at your institution such as skills related to negotiating internal politics, managing other departments' expectations of the

IR department, or how to have a positive impact on the decision-making process at your institution.

Gain an understanding of the issues related to external constituents connected to your institution.

Rate how often you participate in the following IR affinity group activities and then indicate how important the activities are to your development or maintenance of the knowledge and skills in the field of IR.

FREQUENCY of participation in the following activities.				
A great deal	A lot	A moderate amount	A little	None at all

How IMPORTANT is the activity to the development of knowledge and skills in IR?			
Very important	Somewhat important	Somewhat unimportant	Very unimportant

Post question on the IR listserve.

Answer question posted on the IR liststerve.

Read thread of discussion on the IR listserve.

Attend an IR affinity group meeting.

Participate on an IR affinity group sub-committee.

Attend an IR affinity group workshop or training, such as an SPSS workshop or IPEDs training hosted by OSHE (formerly NJCHE).

Communicate with another IR affinity group member directly instead of posting a question to the entire IR listserve.

Open-ended items

In the space below, describe your understanding of the purpose of the IR affinity group.

What are the benefits, if any, of being a member of the IR affinity group?

What are the challenges, if any, of being a member of the IR affinity group?