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Crowdfunding Academic Researchers – the Importance of Academic Social Media Profiles

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Abstract: Traditionally, the main source of funding for university research comes from either private or government grants. Grant schemes are usually highly competitive with low success rates, favour experienced or senior researchers and take considerable time to be processed thereby delaying potential discoveries. In December 2012 pozible.com and Deakin University agreed to create an opportunity for the community funding of Australian university research. Research My World launched to the public in May 2013 with eight campaigns spanning a range of academic discipline areas and project types. Subsequent project cycles have occurred at approximately six monthly intervals and the program was expanded to include research bids from other universities and research centres. As of mid-November 2015, 19 successful research crowdfunding projects have raised more than more than AU$185,000 in funding at Deakin University alone.

This paper presents the results of a research investigation into the Research My World crowdfunding initiative. We detail the method developed for the collection and visualisation of social media data related to the research crowdfunding projects, the analysis of the links between social media activity and project success, and the general guidance for future project cycles that we derived from this analysis.

Keywords: Social media, Research crowdfunding, Twitter, Social network analysis.

1. Introduction

Generally, crowdfunding can viewed as the monetisation of one's social capital - initially the campaigner's personal social network, but then their wider public networks (Hui, Gerber, & Greenberg, 2012). Crowdfunding platforms depend in large part on online social communities. Our previous research has observed that social media activity is critical to crowdfunding success (Verhoeven & Palmer, 2015). Online social media provide not only the connection to the campaigner's social and professional network, but also the means to appeal to, and mobilise, a wider online community that might support the crowdfunding project. Social media systems such as Twitter support such communication, but also provide features that facilitate the channelling of supporters to the donation platform and for supporters to on-share a project message to their social network. Importantly, it is not just the size of a campaigner's social network, or the volume of their messaging that it is predictive of success, it is how information is propagated within their network and their ability to expand their network during the project period.

There is a growing body of evidence that success in crowdfunding depends on social networks in general, and that online social networks are likewise important for crowdfunding via online platforms. While crowdfunding is not a new development – classical composers were known to finance compositions through accepting advance subscriptions – the development of digital social network platforms permits the mobilisation of online supporters, viral marketing opportunities and the ability to connect with geographically remote audiences (Gerber, Hui, & Kuo, 2012; Hemer, 2011). Research has shown that the immediate social network of a campaigner plays an important role in project success – often providing the initial funding for the project (Xu et al., 2014). The Internet has enabled crowdfunders to connect to their own, and indirectly to others', social networks (Lehner, 2013), creating scale and network effects that are materially different to those observed in traditional 'offline' fundraising (Saxton & Wang, 2014). Both small-scale qualitative investigations (Klaebe & Laycock, 2012), and large-scale quantitative investigations (Lu et al., 2014), point to the importance for crowdfunding success of the intentional use of social media as a project communication channel. The latter investigation showed how analysis of the Twitter networks related to crowdfunding projects can be used to develop guidance on the use of social media to assist the success of future projects (Lu et al., 2014). While the literature specifically relating to research crowdfunding is limited, many of the same observations regarding the importance of social media to project success are noted in the research crowdfunding context as well (Kaplan, 2013; Perlstein, 2013; Wheat et al., 2013).

In a recent general review of social media research that included crowdfunding, Wu, Sun, and Tan (2013) noted that campaigners with higher 'social capital' had a higher probability of successfully raising funds. Specifically for the Facebook platform, network size (number of friends/members) has been found to be an important predictor of success, both for project-type crowdfunding (Mollick, 2014) and on-going charitable crowdfunding (Saxton & Wang, 2014). Hekman and Brussee (2013) elaborated on this finding by noting that the Facebook networks of successful crowdfunders were on average: larger (contained more members); were wider in diameter (the shortest number of between-friend links between the two most distant members was larger); and were sparser (the density of links between members of the network was lower). This suggests a more nuanced relationship than simply 'a bigger Facebook friend network is better'. Considering the Twitter platform, (Lu et al., 2014) found that the number of project backers (and hence likelihood of success) increased with the diameter of the network and the number of links between the members of the network. Note that for Facebook the network is the formed by the friends of the crowdfunder and the interconnecting friendship links between those friends, whereas for Twitter the network is formed by all those accounts that send a tweet, or are mentioned in a tweet, relating to the project, with the tweets forming the network links.

Wheat et al. (2013) concluded that, "… the key factor in the fundraising success of a project is not the particular site, but the crowd that a project initiator brings to that site." (p. 71) They also indicated that an outreach effort is required to translate the 'crowd' into crowdfunding. In analysing a large number of projects hosted on a popular crowdfunding platform, Xu et al. (2014) found that those projects employing updates were significantly more successful than those projects not providing updates via the project web page. Further, they analysed the themes in project updates and found that the most common theme was 'social promotion' (encouraging others to promote the project via their social networks), and that the presence of social promotion updates was significantly correlated with project success. Examining the Facebook pages of non-profit organisations that raised funds via Facebook, Saxton and Wang (2014) found a strong 'social network effect', comprised of three elements. First, the ability to reach more prospective donors; second, members of the organisation's social network can solicit donations from their own connections on the organisation's behalf; and third, the public nature of social media can create a level of 'social pressure' on potential donors to be seen to have donated.

So, while there is some evidence that both having and actively leveraging a social media network is an important contributor to the success of crowdfunding projects, there are also calls for additional research in this area. Lehner (2013) report that network theory has been successfully applied in business and capital raising, and that it should be extended to include the context of crowdfunding to understand the role of platforms, payment providers and followers, and the flow of communication and resources through the network created. Gerber, Hui, and Kuo (2012) note that, despite a growing body of research around online communities and social networks, the research examining crowdfunding is still limited. Lu et al. (2014) agree, observing that crowdfunding is a billion dollar business, but that the research into its processes is limited, in particular the role that social networks play in support of crowdfunding success is not well understood. Following good results in the prediction of crowdfunding success based on pledge timeline data and information about project backer connections, Etter, Grossglauser, and Thiran (2013) speculate that a further productive line of research would be to investigate the relationship between project success and the spread of messages on the Twitter network. This paper presents the results of a research investigation into the Research My World crowdfunding initiative. We detail the method developed for the collection and visualisation of social media (Twitter) data related to the research crowdfunding projects, the analysis of the links between social media activity and project success, and the general guidance for future project cycles that we derived from this analysis.

2. Research My World at Deakin University

Research My World (RMW) is an ongoing collaboration between an Australian university (Deakin University) and a successful crowdfunding platform (pozible.com). The initiative began as a pilot arrangement designed to test the public's willingness to directly funding university research and innovation. Subsequent project cycles have occurred at approximately six monthly intervals and the program was expanded to include research bids from other universities and research centres. As of mid-November 2015, 19 successful research crowdfunding campaigns have raised more than more than AU$185,000 in funding at Deakin University alone. This pilot phase was also useful for determining how easily a traditional university could adapt to a networked financing model for academic projects and conversely, how easily a start-up crowdfunding platform could oblige the conservative fiscal and ethical systems of the 'ivory tower'. And for the purposes of this paper, RMW proved to be an excellent opportunity to study and intercede in the online networking activities of the different academics leading the research projects intended to be crowdfunded.

3. Methodology

As the users of social media systems interact, they generate network data that represent the connections between participants, and social network analysis (SNA) can be used to make visible these interactions, to identify strategically important components and participants in the social network, and to show the development of the communication links over time (Smith et al., 2009). SNA has been previously used to research the contribution of social media to crowdfunding (Hekman & Brussee, 2013). For the initial RMW cycle, it was decided to collect a range of data, including Twitter social media. Additionally, it was decided to visualise the RMW Twitter social network progressively to assess the social media interactions and their evolution in real-time during the project. Each individual project campaign was asked to tag all their Twitter activity with a unique (as far as practical) hashtag, and to promote the use of that hashtag by others tweeting about their campaign. The NCapture program (QSR International, 2013a) is able to capture all publicly available data provided by the Twitter application programming interface (API) in response to a search query.

Regular NCapture search queries were run prior to, and throughout, the RMW cycle to capture Twitter data from, and mentioning, the RMW campaign accounts, and Twitter data containing the campaign hashtags. The NVivo program (QSR International, 2013b) was used to convert the captured Twitter data into Microsoft Excel (Microsoft, 2010) spreadsheets. Following processing in Excel, the spreadsheet Twitter data were exported in comma separated values (CSV) format, and then imported into the Gephi program (The Gephi Consortium, 2012) to visualise the social network embodied in the data. As outlined in Figure 1, Gephi can be used to represent Twitter user accounts as 'nodes', and the communication path (representing one or more tweets) between two nodes as an 'edge'. In the Twitter network diagrams used in this paper, edges are presented as curved lines, the direction of tweets is clockwise around the edge, and the width of an edge is proportional to the total number of tweets recorded between the two nodes in that direction.

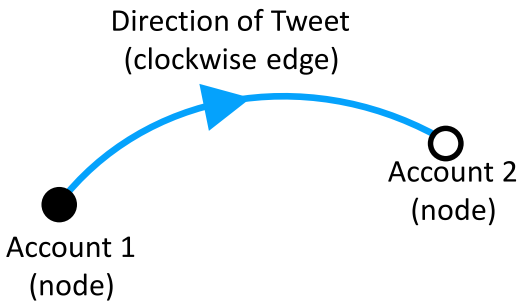

Figure 1: Twitter network visualisation schema

There is a single topological arrangement of the data for a given network, however it can be visualised in many ways. Gephi provides a range of algorithms that can be used to lay out a network according to a set of rules for positioning all of the nodes. In the work presented here the Force Atlas (Akhtar, Javed, & Sengar, 2013) network layout algorithm was used. The Force Atlas algorithm is a type of 'force directed' algorithm. Generically, force directed algorithms assign 'attractive' forces between the endpoints of each edge, and 'repulsive' forces between all nodes in the network. Starting from a random initial state, the structure of the network is then iteratively simulated using a set of configuration parameters until it reaches an equilibrium state (if possible) where the net attractive and repulsive forces on all nodes are in balance. Specifically, a variant of the basic Force Atlas algorithm was used – Force Atlas 3D (Kantert et al., 2014). This algorithm clustered connected nodes closer together and pushed unconnected nodes apart, providing a network visualisation that assisted in qualitatively interpreting the state and evolution of the RMW Twitter communication activity.

4. Results

4.1 Prior to the cycle

Prior to the commencement of the RMW cycle, the project campaigners were encouraged to start developing their social media presence, especially those campaigners with little or no existing social media profile. Figure 2 presents a visualisation of all the captured RMW Twitter activity as at one week prior to the commencement of the cycle, using the schema given in Figure 1. In Figure 2 all nodes (Twitter accounts) have been de-identified, nodes/accounts of project campaigners are shown in black, all other Twitter accounts are shown in white. The width of a network edge is proportional to the number of tweets between the nodes at either end (the 'weight' of the edge). The 'degree' of a node is the number of edges that connect to it. The size of a node is proportional to its weighted degree (the total of the weights of all edges connected to it), which provides a measure of all the captured Twitter activity for each node. All network nodes and edges are in their resultant positions given by the Gephi Force Atlas 3D layout algorithm.

Figure 2 highlighted some important features relevant to understanding the evolution of the RMW Twitter network during the first cycle. The four large nodes at the lower left of the network were related to a single campaign. This campaign was jointly run by two people, and their social media strategy included the creation of Twitter accounts for two fictional characters who would converse with each other, and other Twitter users, about the research project seeking funding. A second campaigner relatively active on Twitter prior to the formal commencement of the cycle can be seen at the mid right. Only four (of eight) campaigns were active on Twitter at that early stage – two other relatively small black campaign nodes can be seen just above the centre of the network. Some of the larger white nodes in the centre belonged to a group of Deakin University staff actively involved in the organisation and support of the RMW initiative – positioned there by the layout algorithm because of their connection to multiple campaigners. The campaign at the lower left (Campaign 1) appeared relatively active, with large nodes (combined weighted degree of 356) and wide edges associated with them, while the campaign at the mid right (Campaign 2) had a smaller node (weighted degree of 43) and was connected to mainly thin edges.

Figure 2: Twitter network visualisation as at one week prior to launch of cycle

Gephi provided a number of quantitative network parameters which illuminated some aspects of how Twitter was being used by campaigns in the promotion of their crowdfunding efforts. Separating just the sub-network associated with Campaign 1 at this point, it contained 33 nodes (unique Twitter accounts) and 74 edges (unique

Twitter paths, which may have been tweeted on more than once). Whereas the sub-network for Campaign 2 contained 63 nodes and 125 edges. So, the much higher volume of Twitter activity from Campaign 1 was being circulated to a much smaller network. The cluster of Campaign 1 nodes at the lower left in Figure 2 that were closely bound by wide edges showed that a lot of the pre-cycle activity for Campaign 1 was a 'performance' of dialogue between the four campaign Twitter accounts. While this may have been entertaining for observers and perhaps helped in building a campaign-related community, Campaign 2 had connected to nearly twice as many Twitter users (63 nodes versus 33) with about one eighth of the activity (weighted degree of 43 versus 356) – a potentially much more efficient/productive Twitter communication pattern in support of their campaign. Another related network parameter of interest was graph density. Graph density is a measure of how complete a network is – a complete network includes all possible edges between all nodes, and has a density of 1.0. For a given number of nodes, a lower density is achieved by connecting them with less edges, again a potentially more efficient Twitter communication pattern. For a directed network (as used here) with *n* nodes and *e* edges, the density (*D*) is given by:

$$D = \frac{e}{n(n-1)}$$

Using the Twitter sub-networks for the two campaigns examined in detail, Campaign 1 had a density of 7.01 per cent complete and Campaign 2 had a density of 3.2 per cent. Again, this provided additional evidence that the 'tweeting amongst themselves' strategy of Campaign 1 was a less efficient Twitter communication pattern. Having made these early observations about Campaign 1 and Campaign 2, and noting that the other campaigns had not yet engaged in significant Twitter activity, the decision to keep a watching brief on the evolution of the RMW Twitter network was confirmed. This early visualisation was shared with all the campaigners along with some general commentary about the different forms of Twitter engagement present, including the observation that the style of Campaign 2 was likely to be the more effective.

4.2 One week into the cycle

Visualisations of the RMW twitter networks were produced every two weeks and presented to the researchers at that time. Figure 3 describes twitter data collected one week into the RMW cycle. It was observed that the general form of the network was similar to Figure 2 – the Campaign 1 cluster on the left, Campaign 2 on the right, and larger white nodes associated with RMW organisers in the centre. Additionally, two more black campaign nodes had appeared in the centre region. Apart from Campaign 1 and Campaign 2, the other four campaign nodes were closely tied to the central region of the network, along with the nodes of the RMW organisers, and were yet to develop their own distinct campaign presences in the RMW Twitter network. Although the RMW network in Figure 3 was significantly larger, and the region associated with Campaign 1 seemed more developed, a detailed examination of the same network parameters reveals a different story. Table 1 summarises these cumulative network parameters for Campaign 1 and Campaign 2 at the time points one week prior and one week following the commencement of the cycle, three weeks into the cycle and at the completion of the cycle (noted below).

At one week into the cycle, based on the weighted degree parameter, it seemed little had changed despite efforts to communicate with the project leaders. Campaign 1 was about four and half times as active as campaign 2, and while the number of nodes and edges in the Campaign 1 sub-network has increased, they were still approximately half the values recorded by Campaign 2. Similarly, while the graph density for Campaign 1 had reduced, it was still approximately twice the value of Campaign 2. Essentially, the same pattern of relatively higher levels of Twitter activity circulating to a relatively smaller network could be seen. Based on this information, the principal researchers behind Campaign 1 finally recognised the issue with the efficiency of their Twitter communication strategy. They realised the need to be more effective in reaching new potential supporters, rather than recirculating messages to largely the same network members. At this point in the cycle, encouragement was given to the Campaign 1 group to expand their Twitter reach, to Campaign 2 to keep up the good work, and to all the other campaigners to step up their Twitter activity.

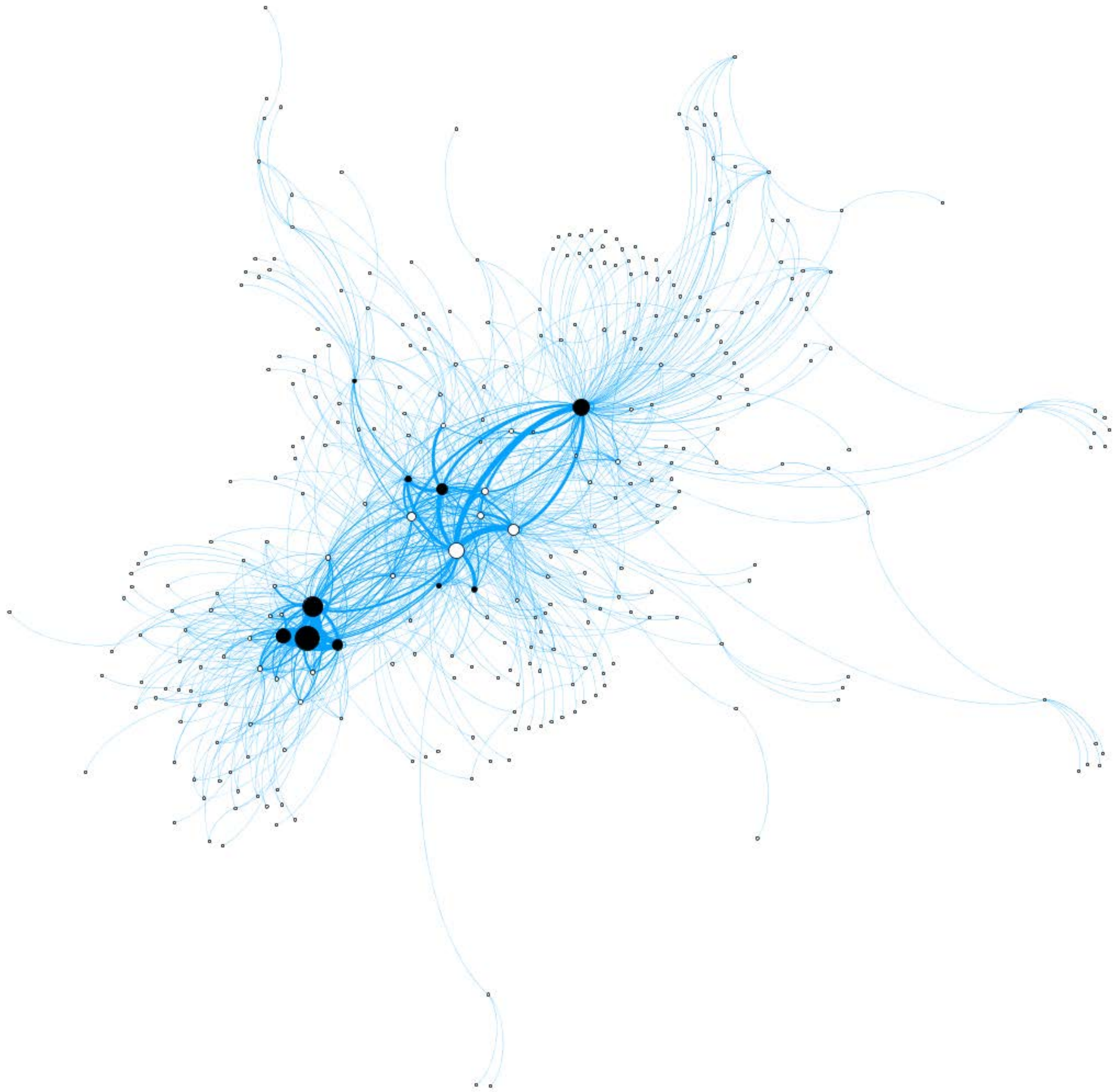

Figure 3: Twitter network visualisation as at one week following the launch of cycle

Table 1: Selected network parameters for Campaign 1 and Campaign 2

Campaign week	**Campaign**	**Weighted degree:** Total connections to campaigner	**Nodes** No. Twitter users in sub-network	**Edges** No. connections in sub-network	**Graph density:** % sub-network complete
-1	1	356	33	74	7.01 %
	2	43	63	125	3.20 %
+1	1	1549	90	263	3.28 %
	2	352	157	423	1.73 %
+3	1	2328	157	421	1.72 %
	2	482	194	550	1.47 %
End	1	4822	306	856	0.92 %
	2	939	355	930	0.74 %

4.3 Three weeks into the cycle

Two weeks later again, and three weeks into the RMW cycle, Figure 4 shows that the general structure of the network was still similar to that previously. Campaign 2 continued to exhibit a wide-reaching sub-network, and some the black campaign nodes in the central region had moved further out and developed some wide-reaching connections of their own. Compared to Campaign 2, Campaign 1 continued with a relatively high volume of Twitter activity, but now had a sub-network exhibiting some extended edge paths, and the network parameters relating to efficiency of communication (nodes, edges and density) were, on average, only 20 per cent different from Campaign 2. Further, the final set of network parameters given in Table 1, indicate that, by the end of the 45 day cycle, following specific actions in response to the provision of the information, feedback and advice, the network parameters for Campaign 1 relating to communication efficiency, were on average only 15 per cent different from Campaign 2.

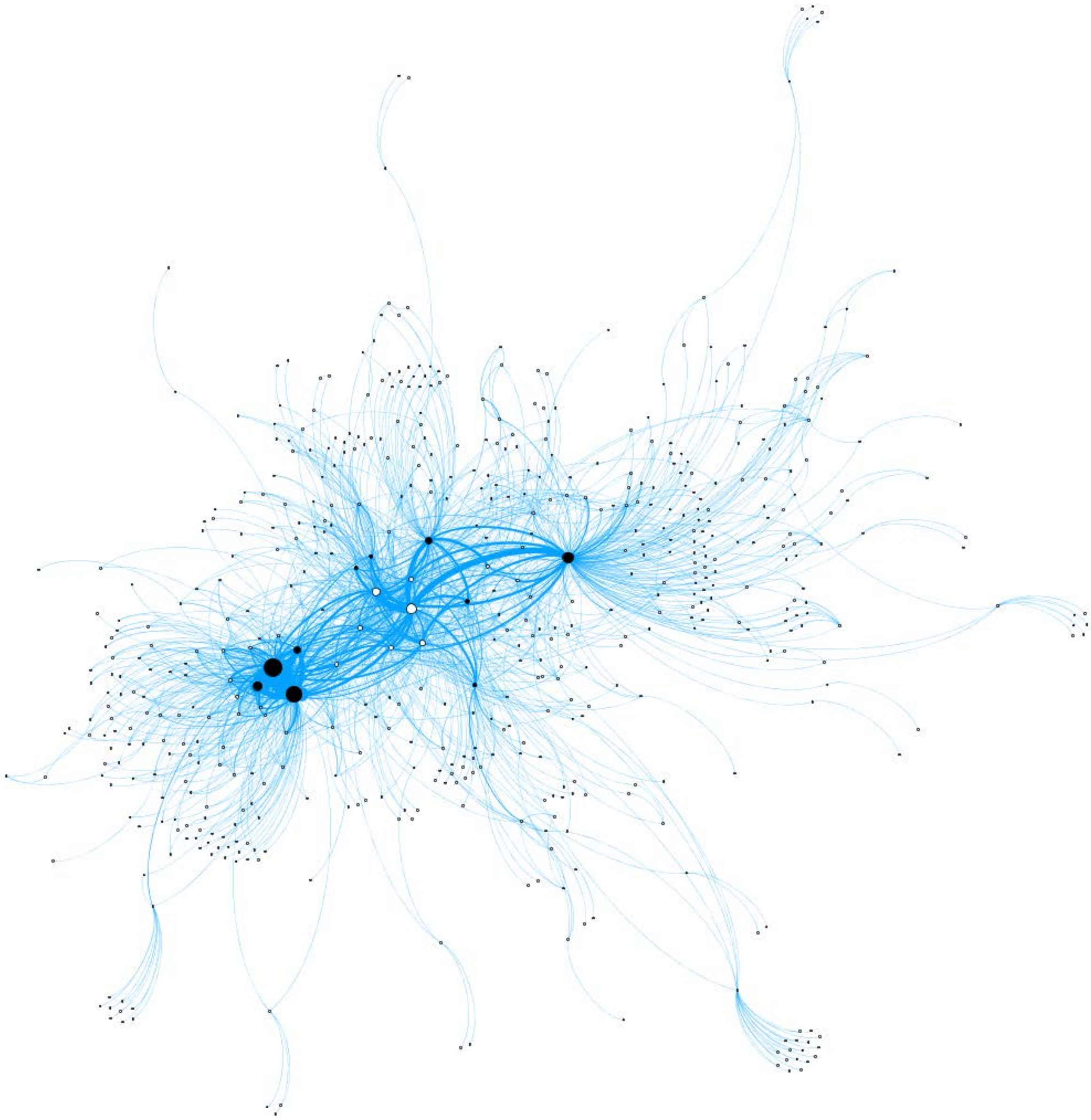

Figure 4: Twitter network visualisation as at three weeks following the launch of cycle

5. Discussion

A complementary insight into the development of the Campaign 1 Twitter communication pattern during RMW cycle one was gained by breaking up all recorded Twitter activity for Campaign 1 into the types of content present: i) tweets (new Twitter posts from Campaign 1); ii) retweets (tweets from others re-posted by Campaign 1); and iii) mentions (tweets posted by others that identify Campaign 1). Generally, a project with lower engagement with its social network is likely have a relatively high proportion of tweets and retweets, compared to mentions. Whereas a project that is more effectively engaging its social network in sharing its message is likely have a relatively high proportion of mentions compared to Twitter activity originating directly from the project. Figure 5 presents the proportions of each of these three types of Twitter activity related to Campaign 1 for each week of the cycle, as well as for the Twitter activity recorded prior to the commencement of the cycle.

Note that the 45 day period of the cycle means that the data shown for week 7 represents less than seven days. The count of all Twitter activity recorded during each week is given at the top of the corresponding column. Commendably, Campaign 1 generated significant preparatory Twitter activity in the lead-up to the commencement of the cycle. However, prior to the launch, and during the initial phase, of the cycle, the majority of the Twitter activity was 'from' Campaign 1, and not 'about' Campaign 1. It can be seen in Figure 5 that as the cycle progressed, the general trend was that an increasing proportion of the recorded Twitter activity was about Campaign 1, such that by the end of the cycle the proportions of 'from' and 'about' were reversed.

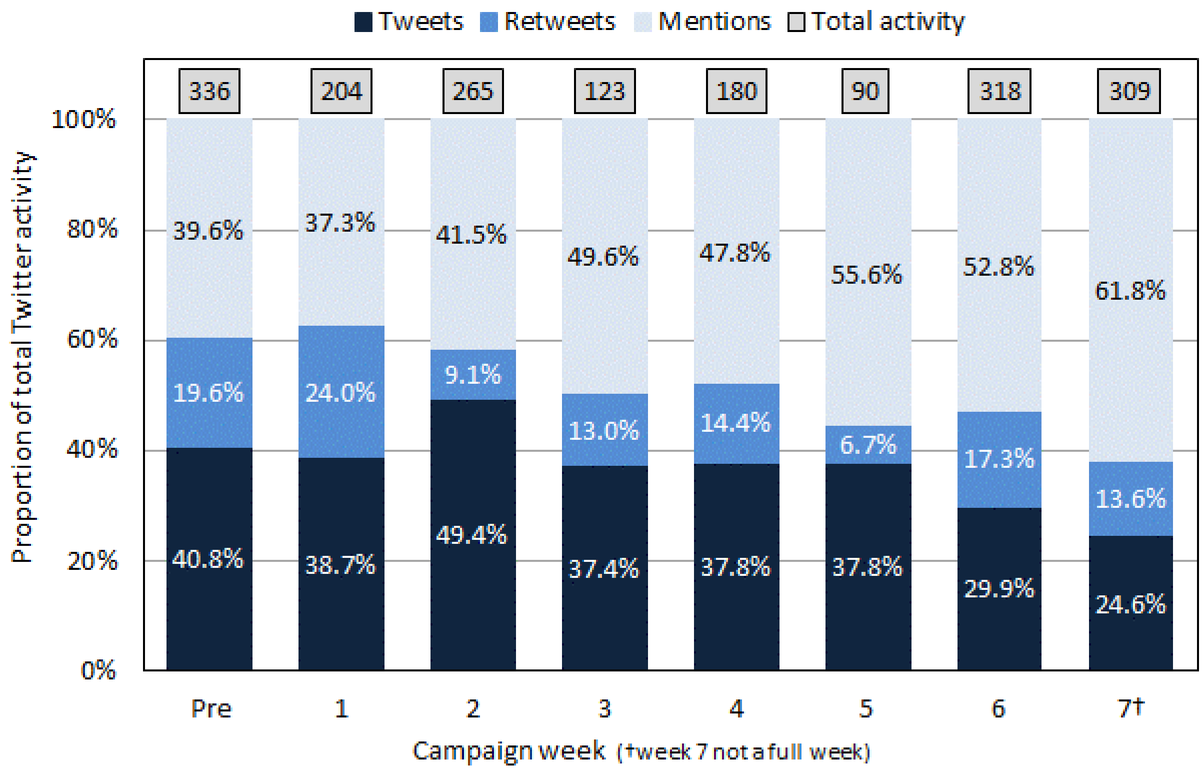

Figure 5: Proportions of Twitter content recorded for Campaign 1 during each week of cycle

In a previous quantitative evaluation of the first cycle of eight RMW projects (Verhoeven & Palmer, 2015), the factors associated with project success were investigated. At the conclusion of the first cycle a data set of more than 50 variables for each of the projects was developed. Variables of interest were identified as having a large and significant correlation with project success status (Hekman & Brussee, 2013; Lu et al., 2014; Mollick, 2014). This step identified eight predictor variables, of which some were clearly intercorrelated. Principal Component Analysis was used to reduce the dimensionality of the predictor variable set to three general factors, two of which had a significant association with project success. They were:

- **The topological width of the Twitter network associated with the project** – including the variables for the diameter of the Twitter network, the average directed path length of the Twitter network, the average undirected path length of the Twitter network, and the average Twitter network Erdős number for the project principal; and
- **Inbound and outbound traffic to/from the project website** – including the variables for the number of social media shares from the project website, the total page view count for the project website, and the total unique page view count for the project website.

The results of this evaluation were strongly congruent with research results documented in the related literature noted above. These results were formalised into guidance provided to project principals undertaking research crowdfunding in subsequent cycles of RMW. A successful crowdfunding project typically leverages the reach of a social network not by sending lots of tweets per se, but by extending the sequence of retweets and other re-broadcasts about their project to new/unique potential pledgers. In particular, a successful crowdfunding project will drive potential supporters to their project website, and encourage those viewers to share the project website with others. Every opportunity should be taken to include a live clickable link in any online references to the project, and communication on the project website should specifically ask the reader to hit the appropriate social media share buttons. The social network analysis results presented above supported this early quantitative evaluation in showing that Twitter network reach was an important contributor to research crowdfunding success.

6. In conclusion

Existing research relating to academic crowdfunding is very limited and generally qualitative/descriptive in nature. Several recent researchers have called for more investigation into the relationship between social networks and crowdfunding success (Etter, Grossglauser, & Thiran, 2013; Gerber, Hui, & Kuo, 2012; Lehner, 2013; Lu et al., 2014). Our research responds to these calls by investigating how social network analysis revealed insights into the progress of campaigns while they were underway. Our analyses delivered practical benefits to researchers in the Research My World pilot initiative, allowing us to provide advice in real-time so that campaigners could adjust and optimise their social media communication strategies. We were able to visualise the developing Twitter networks of the campaigners, and to 'see', visually and quantitatively, evidence of the positive impact of the advice that we provided to the campaigners.

The research described offered a method for monitoring the progress of research crowdfunding campaigns via Twitter in real-time, a source of general advice to intending campaigners about the importance of promoting their campaigns via social media, and a model for productive forms of social media engagement for campaigners. However, there are a number of limitations of the research and/or opportunities for future research to note. The process of social media data collection and visualisation was time consuming, and a more systematic approach would look to automate the process if possible. While the utility of the general advice that we have been able to provide to intending campaigners has proven to be of value over several subsequent cycles of RMW, the diversity of the researchers and their campaign topics ranged across many disciplines, and it is likely that the widely differing nature of the campaigns places some limits on the value of generic advice regarding the use of social media in support of their campaigns. For example, while the evaluation of the first RMW cycle noted above pointed to the use of Twitter being more important than other social media platforms such as Facebook, it was observed that certain specific campaigns used Facebook to good effect in connecting with social networks related to their campaign theme, and that were already established on Facebook. The role of Facebook and other social media platforms in support of research crowdfund campaigns could be more closely investigated.

Social media platforms continue to evolve in the functions and affordances that they offer. Even during the period of the RMW initiative so far, the format of the data provided by the Twitter API has changed, necessitating modifications to the data collection and processing methods. Crowdfunding platforms generally also continue to proliferate, develop and in some cases consolidate. Research crowdfunding itself is still a relatively new concept, and as the public understanding of, and responses to, research crowdfunding evolve over time, additional research is likely to be needed to characterise the role that social media can play in support of research crowdfunding. Similarly, research crowdfunding platforms are not a static, and new models continue to develop – such as the thinkable.org platform which employs a 'competition' model where the public audience votes for a winner from a range of candidate campaigns. Different research crowdfunding models will likely engage different donor audiences in different modes, and how social media can most effectively support different models of research crowdfunding will be a research topic of great interest.

The pilot project discussed in this paper placed an emphasis on the individual researchers or research teams taking responsibility for their respective social media campaigns, with little support or exposure provided via official university channels. Future development of crowdfunding at Deakin University will see a greater formal institutional uptake of crowdfunding, and this will have interesting repercussions for the development of greater cohort-based and corporate-derived social media use.

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