

# DESERT KNOWLEDGE CRC

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Network Analysis  
Baseline Data for  
Bid and Start-up Period

Christof Pforr,  
Aggie Wegner,  
Murray McGregor,  
Curtin University of  
Technology

Report

7

September  
2005





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The Desert Knowledge Cooperative Research Centre (DK-CRC) is an unincorporated joint venture with 27 partners whose mission is to develop and disseminate an understanding of sustainable living in remote desert environments, deliver enduring regional economies and livelihoods based on Desert Knowledge, and create the networks to market this knowledge in other desert lands.

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## Summary

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One of the key performance indicators for the Desert Knowledge Cooperative Research Centre (DK-CRC) was ‘to enhance collaboration among researchers, [and] between researchers and industry or other users, and to improve efficiency in the use of intellectual and other resources’. The DK-CRC Board instigated this network analysis study to develop a longitudinal view of the DK-CRC’s impact in developing new networks, and enhancing those already in existence, across desert areas and between the coast and desert areas. In addition, the study was established to describe and explain the complex nature of the interaction between the various players within the structure of the DK-CRC (e.g. Management Team, Board, project leaders and users of the CRC’s research outputs). This first report provides the baseline analysis of the effectiveness of collaboration and communication activities among the DK-CRC stakeholders during the pre-approval and initial start-up phases.

The research highlights how the roles played by individuals and groups (Board, Management Team, project leaders etc.) have changed through the period of study. The results show the rise of the Management Team in terms of its perceived relative influence during the establishment phase of the CRC. These perceptions are largely mirrored in the collaboration and communication networks that have been established where the Management Team has been particularly active. The Management Team plays a crucial role in building bridges between itself and the various research activities within the four DK-CRC themes. All in all, many collaborative activities have taken place, but with marked differences between the four research themes. Members of Theme III and IV appear to be the most active in reaching out to other research themes. It is also interesting to note that although the Northern Territory stakeholders dominate the reputation networks, regional representation in the various collaboration structures appears to be much more balanced. A clear delineation has been found between the Board members, who are shown not to play any significant role in collaborative research activities, and the Management Team, which is responsible for implementing research.



# Introduction

The DK-CRC Board established this longitudinal study on networks and their development across DK-CRC stakeholders as part of the DK-CRC's commitment to achieve its aims and objectives through a partnership with industry, universities, desert communities, Indigenous organisations, and government and non-government organisations. Thus, the purpose of this research is to help better understand how stakeholders have worked together and exchanged information since the development of the DK-CRC partnership and then to track changes to these communication and collaboration networks on a regular basis over the life of the CRC through a social network analysis approach.

An initial set of 81 DK-CRC stakeholders (Table 1) were identified and invited to participate in an online survey. They included, for instance, individuals from the DK-CRC Management Team, the DK-CRC Board, theme and project leaders of the four DK-CRC themes, researchers and administrative staff, as well as DK-CRC partners and associate partners, such as land councils, government departments, universities and businesses, and members of the Desert Advisory Forum.

Table 1. DK-CRC Stakeholder profile

| Region                             | In % | Function / Role             | In % * | Research Theme (RTh) | In %  |         |
|------------------------------------|------|-----------------------------|--------|----------------------|-------|---------|
|                                    |      |                             |        |                      | Total | Per RTh |
| Northern Territory (NT)            | 42   | Board Member (B)            | 11     |                      |       |         |
| South Australia (SA)               | 17   | Management Team (M)         | 14     | Theme I              | 16    | 27      |
| Western Australia (WA)             | 17   | Participants' Forum (PF)    | 17     | Theme II             | 9     | 16      |
| Australian Capital Territory (ACT) | 9    | Desert Advisory Forum (DAF) | 11     | Theme III            | 20    | 36      |
| Queensland (QLD)                   | 7    | Project Leader (PL)         | 57     | Theme IV             | 12    | 21      |
| New South Wales (NSW)              | 6    | Theme Leaders I-IV (LTh)    | 5      |                      |       |         |
| Victoria (VIC)                     | 1    |                             |        |                      |       |         |

Note: Stakeholder profiles based on initial stakeholder list

\* > 100% since some stakeholders serve in several roles

This report summarises the results from the first online survey, covering the period prior to the CRC gaining funding and the initial start-up period, and will be used to build the baseline data for the upcoming follow-up surveys, as it is anticipated that in the future, stakeholders will be invited on a quarterly basis to participate in the survey. This ongoing monitoring of the DK-CRC's communication and collaboration activities will allow the identification of any trends or shifts in the underlying network structures through time. These will be analysed in detail in the Network Analysis project's major annual reporting.

The software programs used to measure and visualise the relational constellations between DK-CRC stakeholders were UCINET, a specific program designed for social network analysis, and NetDraw.



## Results and Discussion

A total of 41% of DK-CRC stakeholders (Table 2) responded to the online survey for the first quarter in 2005, which comprised four short questions.

Question One of the survey was divided into three subsections:

- (a) ‘Who was most influential within the DK-CRC partnership leading up to its approval (i.e. prior to 2003)?’;
- (b) ‘Who was most influential within the DK-CRC partnership during its implementation phase (i.e. during 2003)?’; and
- (c) ‘Who was most influential within the DK-CRC partnership during its initial operational phase (i.e. during 2003–04)?’.

Table 2. Respondents' profiles

| Region                             | In %       |            | Function / Role             | In % *     |            | Research Theme (RTh) | In %       |         |
|------------------------------------|------------|------------|-----------------------------|------------|------------|----------------------|------------|---------|
|                                    | Total Pop. | Per Region |                             | Total Pop. | Per Region |                      | Total Pop. | Per RTh |
| Northern Territory (NT)            | 43         | 41         | Board Member (B)            | 9          | 33         |                      |            |         |
| South Australia (SA)               | 21         | 50         | Management Team (M)         | 21         | 64         | Theme I              | 9          | 25      |
| Western Australia (WA)             | 12         | 29         | Participants' Forum (PF)    | 12         | 29         | Theme II             | 9          | 43      |
| Australian Capital Territory (ACT) | 5          | 29         | Desert Advisory Forum (DAF) | 15         | 56         | Theme III            | 24         | 50      |
| Queensland (QLD)                   | 9          | 50         | Project Leader (PL)         | 55         | 39         | Theme IV             | 15         | 55      |
| New South Wales (NSW)              | 9          | 60         | Theme Leaders I-IV (LTh)    | 15         | 100        |                      |            |         |
| Victoria (VIC)                     | 0          | 0          |                             |            |            |                      |            |         |

\* > 100% since some stakeholders serve in several roles

An analysis of the distribution of the stakeholders identified as being the most influential prior to the DK-CRC's approval (Table 3) shows that within this group 50% of the nominated individuals are associated with the Management Team and 42% are Board members. Furthermore, all theme leaders were identified, most likely a result of their multiple roles of being theme and project leaders as well as belonging to the Management Team. However, only one individual outside the two main clusters – Board and Management Team – was included in this reputation elite, a member of the Participants' Forum. Most of the influential stakeholders prior to approval appear to be located within the Northern Territory, with the only exceptions being one nomination from Western Australia and one from New South Wales.

Table 3. Participants' ranking of the most influential stakeholders prior to the DK-CRC approval

| Stakeholder ID | Nominations * | Function(s) / Role(s)                           | Research Theme | Region |
|----------------|---------------|-------------------------------------------------|----------------|--------|
| 64             | 1.00          | Management Team / Project Leader                | I              | NT     |
| 18             | 0.68          | Board Member                                    |                | NT     |
| 28             | 0.64          | Board Member                                    |                | NT     |
| 19             | 0.55          | Management Team / Project Leader                | IV             | NT     |
| 77             | 0.55          | Board Member                                    |                | NSW    |
| 29             | 0.50          | Management Team / Theme Leader / Project Leader | III            | NT     |
| 46             | 0.50          | Management Team / Theme Leader / Project Leader | IV             | WA     |
| 3              | 0.45          | Board Member                                    |                | NT     |
| 41             | 0.45          | Participants' Forum                             |                | NT     |
| 8              | 0.36          | Board Member                                    |                | NT     |
| 39             | 0.36          | Management Team / Theme Leader / Project Leader | I              | NT     |
| 16             | 0.32          | Management Team / Theme Leader / Project Leader | II             | NT     |

\* Rescaled to a maximum score of 1.00

Following the pre-approval stage, an analysis of the implementation phase of the DK-CRC did not unveil any great changes. Table 4 displays the reputation elite of the DK-CRC during this period, notably with two new entries, Stakeholders 10 and 20. During this phase the Management Team apparently gained in importance, as 73% of the identified influential stakeholders are part of this group. The remaining 27% are members of the DR-CRC Board, with no other stakeholder group represented among this network elite. In particular, those stakeholders with multiple functions (#16, 20, 29, 39, 46) appear to have played a significant role not only prior to the CRC's establishment, but also in its implementation and initial operational phase, as is evident in Table 5.

Table 4. Participants' ranking of the most influential stakeholders during the implementation phase of the DK-CRC

| Stakeholder ID | Nominations * | Function(s) / Role(s)                           | Research Theme | Region |
|----------------|---------------|-------------------------------------------------|----------------|--------|
| 64             | 1.00          | Management Team / Project Leader                | I              | NT     |
| 29             | 0.79          | Management Team / Theme Leader / Project Leader | III            | NT     |
| 19             | 0.75          | Management Team / Project Leader                | IV             | NT     |
| 20             | 0.71          | Management Team / Theme Leader / Project Leader | III            | SA     |
| 39             | 0.71          | Management Team / Theme Leader / Project Leader | I              | NT     |
| 46             | 0.71          | Management Team / Theme Leader / Project Leader | IV             | WA     |
| 16             | 0.67          | Management Team / Theme Leader / Project Leader | II             | NT     |
| 28             | 0.67          | Board Member                                    |                | NT     |
| 77             | 0.63          | Board Member                                    |                | NSW    |
| 10             | 0.50          | Management Team / Project Leader                | III            | NT     |
| 18             | 0.68          | Board Member                                    |                | NT     |

\* Rescaled to a maximum score of 1.00

There is no significant difference between the reputation elites of the DK-CRC implementation phase and its operations thus far. The only new entrants are Stakeholder 11, a DK-CRC Board member, and Stakeholder 17, a member of the Management Team. Again, three-quarters of the identified elite are associated with the Management Team and one-quarter with the Board; no stakeholder outside these two very important functional clusters has yet been able to gain an influential reputation.

Thus, the analysis of Question One, the transition from the DK-CRC's initiation to its operation, has shown that the Management Team, as the DK-CRC's core functional group, was able to increase its influential reputation from 50% to 75% and the Board decreased in importance respectively. No other stakeholder groups have played any significant role thus far. It is also notable, but not surprising considering the regional spread of DK-CRC stakeholders (see Table 1), that those perceived to be the most influential have in the main been from the Northern Territory.

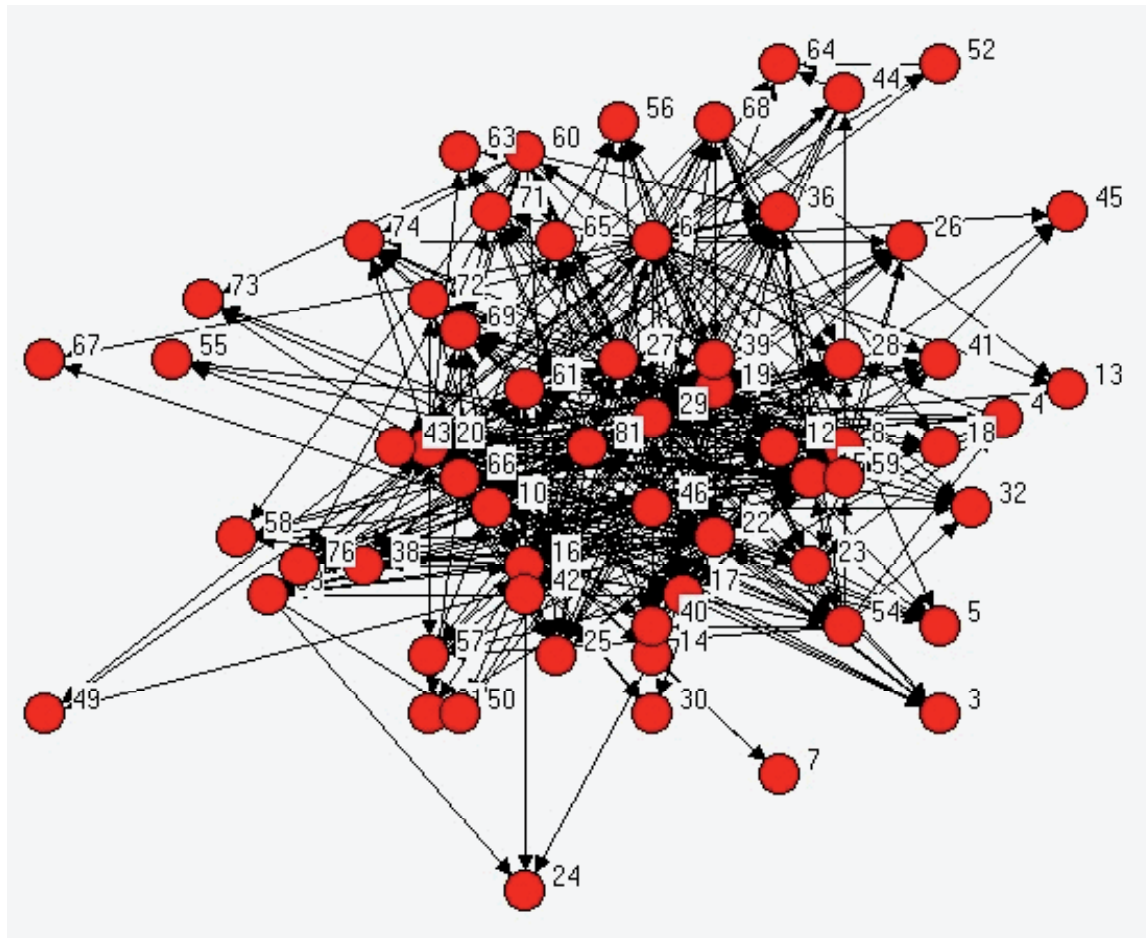
Table 5. Participants' ranking of the most influential stakeholders during the initial operational phase of the DK-CRC

| Stakeholder ID | Nominations * | Function(s) / Role(s)                       | Research Theme | Region |
|----------------|---------------|---------------------------------------------|----------------|--------|
| 64             | 1.00          | Management Team Project Leader              | I              | NT     |
| 20             | 0.80          | Management Team Theme Leader Project Leader | III            | SA     |
| 29             | 0.80          | Management Team Theme Leader Project Leader | III            | NT     |
| 16             | 0.76          | Management Team Theme Leader Project Leader | II             | NT     |
| 28             | 0.72          | Board Member                                |                | NT     |
| 39             | 0.72          | Management Team Theme Leader Project Leader | I              | NT     |
| 11             | 0.64          | Board Member                                |                | WA     |
| 46             | 0.64          | Management Team Theme Leader Project Leader | IV             | WA     |
| 77             | 0.64          | Board Member                                |                | NSW    |
| 17             | 0.60          | Management Team                             |                | NT     |
| 19             | 0.60          | Management Team Project Leader              | IV             | NT     |
| 10             | 0.56          | Management Team Project Leader              | III            | NT     |

\* Rescaled to a maximum score of 1.00

Question Two aimed to gain a clear understanding of the level of collaboration among DK-CRC stakeholders: in other words, the sharing of knowledge and understanding for the purposes of research. Based on the responses received, a social network map was generated to illustrate the overall linkages and interactions among the stakeholders (Figure 1). Despite its rather complex and active appearance, the network's density was calculated to be 0.08 (from a possible range of zero to one); hence, at present, collaboration among DK-CRC stakeholders appears not to be particularly high.

Figure 1. Social network map of DK-CRC stakeholders' collaboration



### DK-CRC collaboration elite

Those in the above collaboration elite (see also Table 6) are rather active within their respective functional and/or regional spheres, as is evident in the considerably higher network density (0.68) in the respective sub-network structure (Figure 2). It has to be highlighted that, again, those individuals with multiple functions have been particularly active. Thus, they play a crucial role in building bridges between the Management Team and the various research activities within the four DK-CRC themes. At this stage only the link to Theme I seems to be less strong. It is also interesting to note that although Northern Territory stakeholders dominate the reputation networks, the regional representation in the various collaboration structures appears to be much more balanced. Moreover, in contrast to the findings of Question One, Board members do not appear to play any significant role in collaborative research activities, a result which is not surprising, considering their assigned role.<sup>1</sup> In fact, there is only one actor within this elite who is not directly associated with any research project, Stakeholder #6 from the Participants' Forum.

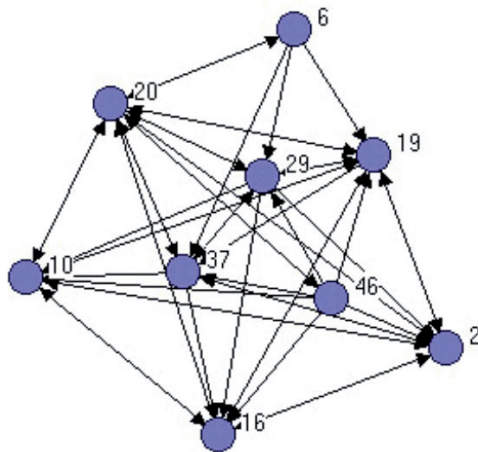
1. As outlined in the DK-CRC 2003–2004 Annual Report (DK-CRC 2004), the Board devolves the day-to-day management of the Centre to the Management Team. It sets the governance standard from the Chair down, linking business, public and non-Indigenous involvement.

Table 6. DK-CRC collaboration elite

| Stakeholder ID | Nominations * | Function(s) / Role(s)                       | Research Theme | Region |
|----------------|---------------|---------------------------------------------|----------------|--------|
| 29             | 1.00          | Management Team Theme Leader Project Leader | III            | NT     |
| 20             | 0.98          | Management Team Theme Leader Project Leader | IV             | SA     |
| 19             | 0.80          | Management Team Project Leader              | IV             | NT     |
| 10             | 0.76          | Management Team Project Leader              | III            | NT     |
| 6              | 0.76          | Participants' Forum                         |                | QLD    |
| 37             | 0.76          | Project Leader                              | III            | ACT    |
| 2              | 0.69          | Project Leader                              | II             | WA     |
| 46             | 0.69          | Management Team Theme Leader Project Leader | IV             | WA     |
| 16             | 0.67          | Management Team Theme Leader Project Leader | II             | NT     |

\* Rescaled to a maximum score of 1.00

Figure 2. Network map of the DK-CRC collaboration elite



## Collaboration within the Management Team

The management team consists of the DK-CRC's CEO, a business manager, office manager, networking and communications officer, networking and communications manager, education manager and the leaders of the four research themes. Its assigned role is to facilitate and foster education and training capabilities, commercialisation and capacity-building through the DK-CRC's research activities (DK-CRC 2004, 2005).

In comparison to the overall network structure, collaboration amongst members of the Management Team (Figure 3) has been particularly high (density 0.49). As many of the Management Team members were identified in the overall collaboration elite, there are no great surprises in this particular focus of analysis (Table 7). Again, those stakeholders with multiple roles within the Management Team were found to be the most active acting as a bridge between Management and the various research teams. Almost all of them achieved a similarly high nomination score. Stakeholders with lower nomination scores were those from the purely administrative arm of the DK-CRC's operations. From the analysis it became also apparent that the Northern Territory has been a dominant factor from a regional point of view, which can easily be explained though, considering that the DK-CRC's administrative centre is based in Alice Springs (NT).

Figure 3. Collaboration within the DK-CRC Management Team

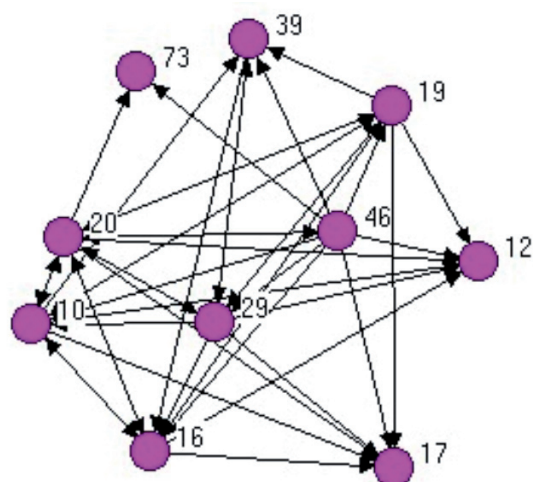


Table 7. Collaboration within the DK-CRC Management Team

| Management Team ID | Nominations* | Additional Function(s) / Role(s) | Research Theme | Region |
|--------------------|--------------|----------------------------------|----------------|--------|
| 46                 | 1.00         | Theme Leader Project Leader      | IV             | WA     |
| 10                 | 0.89         | Project Leader                   | III            | NT     |
| 16                 | 0.89         | Theme Leader Project Leader      | II             | NT     |
| 19                 | 0.89         | Project Leader                   | IV             | NT     |
| 20                 | 0.89         | Theme Leader Project Leader      | IV             | SA     |
| 29                 | 0.89         | Theme Leader Project Leader      | III            | NT     |
| 12                 | 0.67         |                                  |                | NT     |
| 17                 | 0.67         |                                  |                | NT     |
| 39                 | 0.56         | Theme Leader Project Leader      | I              | NT     |
| 73                 | 0.22         |                                  |                | NT     |

Note: Excluding pendants (i.e. #64)

\* Rescaled to a maximum score of 1.00

## Collaboration across Research Themes

As is evident from Figure 4, the level of collaboration amongst members of the four DK-CRC research themes is relatively complex. All in all, a lot of collaborative activities have taken place, but with marked difference between the four research themes. Members of Themes III and IV appear to be most active in reaching out to other research themes, whereas Theme I was the least active in this respect. Furthermore, the level of collaboration between Themes I and II was found to be relatively low compared with other interactions across Themes (Table 8).

Figure 4. Collaboration between members of the four research themes

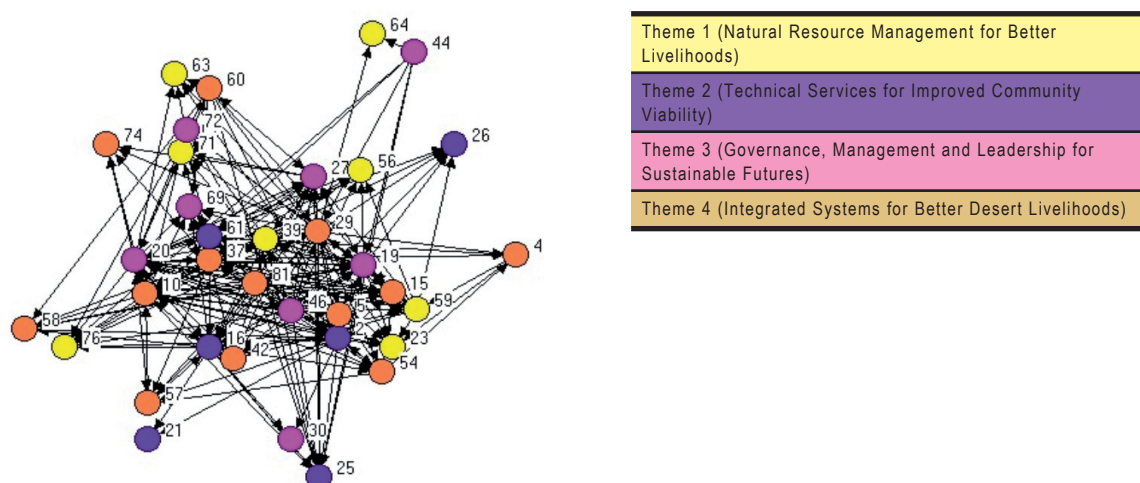


Table 8. Collaborative activity across Research Themes

|                    |                                                                                                                    |
|--------------------|--------------------------------------------------------------------------------------------------------------------|
| Research Theme I   | 76 (with II, III, IV); 39 (with III, IV); 59 (with III, IV); 23 (with III, IV)                                     |
| Research Theme II  | 16 (with I, III, IV); 61 (with III, IV); 26 (with III, IV); 16 (with III, IV); 2 (with III, IV); 25 (with III, IV) |
| Research Theme III | 60 (with I, II, IV); 81 (with I, II, IV); 10 (with I, II, IV); 29 (with I, II, IV); 37 (with I, IV)                |
| Research Theme IV  | 20 (with I, II, III); 27 (with I, II, III); 19 (with I, II, III); 46 (with I, II, III)                             |

## Collaboration between project leaders

The level of density with respect to collaboration between the project leaders was found to be relatively low (0.20), although the respective network map (Figure 5) appears to be very active. This might be because even though there was a high percentage of project leaders among all identified stakeholders, there was fairly limited collaboration in their research activities. The elite of this sub-network is displayed in Table 9. There are no great surprises, as the key stakeholders within this structure are those discussed previously who play multi-functional roles within the DK-CRC. As has been the case in the discussion above, Theme I again appears to be somewhat less prominent in its collaborative activities.

Figure 5. Collaboration among DK-CRC project leaders

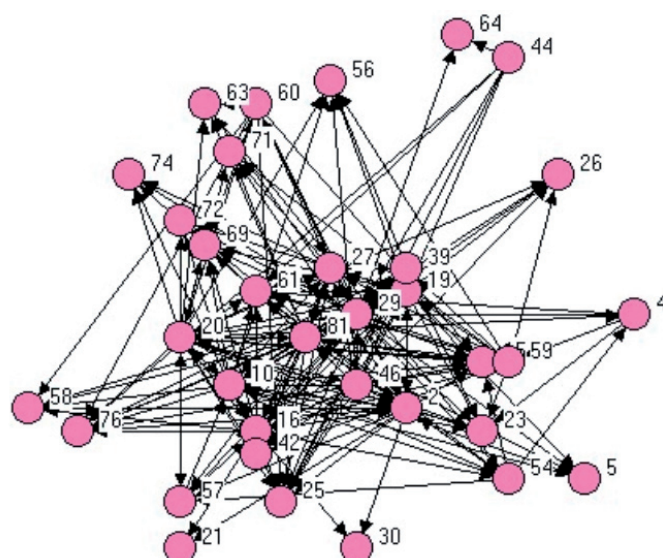


Table 9. Collaboration between DK-CRC project leaders

| Project Leader ID | Nominations * | Additional Function(s) / Role(s) | Research Theme | Region |
|-------------------|---------------|----------------------------------|----------------|--------|
| 20                | 1.00          | Management Team Theme Leader     | IV             | SA     |
| 29                | 1.00          | Management Team Theme Leader     | III            | NT     |
| 10                | 0.86          | Management Team                  | III            | NT     |
| 19                | 0.82          | Management Team                  | IV             | NT     |
| 37                | 0.79          |                                  | III            | ACT    |
| 2                 | 0.75          |                                  | II             | WA     |
| 16                | 0.75          | Management Team Theme Leader     | II             | NT     |
| 46                | 0.71          | Management Team Theme Leader     | IV             | WA     |

\* Rescaled to a maximum score of 1.00

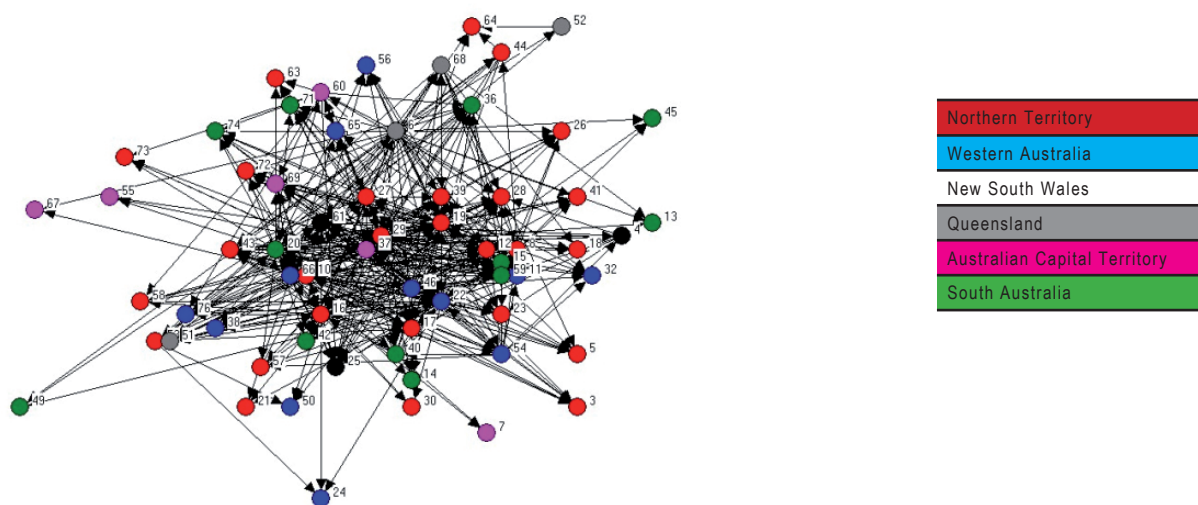
## Collaboration across the regions

For this part of the project, the analysis has taken a regional perspective, analysing collaborative research activities clustered by regional affiliation. Although the overall regional network map (Figure 6) gives the impression of a very active network structure, the actual density is rather low (0.20). Stakeholders from all regions except Victoria appear to be active across regional boundaries, with interactions by stakeholders from the Northern Territory, South Australia and Western Australia the most common (Table 10). It is interesting to note that the various project leaders appear to be the driving force behind this working across regional boundaries.

Table 10. Collaborative activity across States and Territories

|                              |                                             |
|------------------------------|---------------------------------------------|
| Northern Territory           | #29 (M), #81 (PL), #19 (M, PL), #10 (M, PL) |
| Western Australia            | #2 (PL), #46 (M, LTH, PL), #54 (PL)         |
| New South Wales              | #61 (PL), #25 (PL)                          |
| Queensland                   | #6 (PF), #68 (B, DAF)                       |
| Australian Capital Territory | #60 (PL), #37 (PL)                          |
| South Australia              | #20 (M, LTH, PL), #15 (PL), #59 (PL)        |

Figure 6. DK-CRC collaboration across states and territories



Questions Three and Four aimed to gain information on communication and the exchange of general information between DK-CRC stakeholders. The focus was thus on the activity of sending and receiving general information about DK-CRC research activities that would normally be sent to partners, or received from them, in a more informal capacity. For the analysis, responses to both questions were merged and subjected to a multiplex operation, which allowed the information to be displayed in the network maps ‘information exchange in general’ as well as ‘two-way communications only’ (the latter allowing an additional level of analysis). Figure 7 illustrates the level of information exchange across DK-CRC stakeholders, which was rather low, with a density of 0.15. It was also found that only about 50% of these communication links were two-way exchanges. As was the case in the collaboration network, those actors with multiple functions again appear to be the most active in the exchange of information. The prominent role of members of the DK-CRC Management Team was anticipated, based on their official assigned responsibilities. All in all, the emerging picture is very similar to what has already been discussed, thus a further investigation of specific sub-networks is at this stage not warranted.

Figure 7. Information exchange across DK-CRC stakeholders

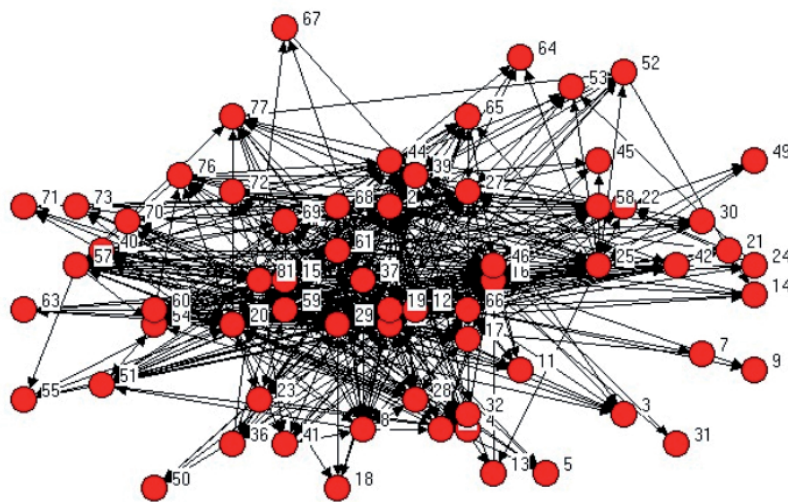


Table 11. Information exchange across DK-CRC stakeholders

| Stakeholder ID | Nominations * | Function(s) / Role(s)                           | Research Theme | Region |
|----------------|---------------|-------------------------------------------------|----------------|--------|
| 29             | 1.00          | Management Team / Theme Leader / Project Leader | III            | NT     |
| 20             | 0.94          | Management Team / Theme Leader / Project Leader | IV             | SA     |
| 2              | 0.94          | Project Leader                                  | II             | WA     |
| 19             | 0.88          | Management Team / Project Leader                | IV             | NT     |
| 10             | 0.88          | Management Team / Project Leader                | III            | NT     |
| 16             | 0.75          | Management Team / Theme Leader / Project Leader | II             | NT     |
| 46             | 0.69          | Management Team / Theme Leader / Project Leader | IV             | WA     |
| 81             | 0.63          | Project Leader                                  | III            | NT     |
| 66             | 0.59          | Project Leader                                  | III            | ACT    |
| 27             | 0.57          | Project Leader                                  | III            | NT     |

\* Rescaled to a maximum score of 1.00



## Conclusion

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This first round of the DK-CRC Network Analysis was successful in establishing baseline data concerning the effectiveness of collaboration and communication activities among its stakeholders during its first years of operation. Furthermore, those stakeholders perceived to be the most influential during the pre-approval stage of the DK-CRC up to its initial operational phase were identified. Of these, members of the DK-CRC Board and Management Team dominated the influential reputation elites; although, it must be noted that the perceived relative influence of the former declined during the course of DK-CRC's set-up and initial operations.

These perceptions are mirrored to a certain degree in the established collaboration and communication networks. Here the obtained data have been analysed from a functional and also regional perspective by establishing respective sub-networks and clusters. From these it can be concluded that members of the Management Team, and here especially those stakeholders with multiple roles, have been particularly active. Thus, they play a crucial role in building bridges between the Management Team and the various research activities within the four DK-CRC themes. All in all, many collaborative activities have taken place; however, with marked differences between the four research themes. Members of Theme III and IV appear to be the most active in reaching out to other research themes. It is also interesting to note that although Northern Territory stakeholders dominate the reputation networks, the regional representation in the various collaboration structures appears to be much more balanced. Stakeholders from all regions except Victoria have been active across regional boundaries, with interactions by stakeholders from the Northern Territory, South Australia and Western Australia the most common. It is of interest that the various project leaders appear to be the driving force behind this working across regional boundaries. On the other hand, Board members do not appear to play any significant role in collaborative research activities – a result which is not surprising, however, considering their assigned role.

The questionnaire has also aimed to establish the more informal channels of communication through which information is exchanged. The overall picture emerging from this focus of analysis was found to be very similar to the established collaboration activities.

All in all, despite the rather complex and active appearance of some of the established network maps, the densities of the underlying sub-networks tend to be rather low, illustrating that, at present, collaboration and communication among DK-CRC stakeholders does not appear to be particularly high. But, considering the dynamic nature of network structures, it can be anticipated that this will change in the months to come. It will thus be interesting to continue monitoring these activities so that the findings in this longitudinal study can be compared and areas requiring further improvement can be identified. The success of this undertaking will strongly depend on the continuing support of all stakeholders and their willingness to participate in the ongoing survey activities.



## References

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Desert Knowledge CRC (2005) Desert Knowledge Cooperative Research Centre website

<[www.desertknowledge.com.au](http://www.desertknowledge.com.au)>.

