

# Asset Management Tools for Change – Social Network Analysis

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This article presents results from a case study of employing social network analysis as a tool to identify barriers to change in asset management. The conclusions drawn in this article are based on real data and were validated by revisiting the research partner.

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Much has been written and commented on regarding the complexity of invoking change within the asset management environment. In an attempt to create a stabilised procedural approach to implementing a management system in alignment with business goals the Institute for Asset Management in the UK and more recently ISO have developed standards for asset management. The goal of these standards is to drive performance of the assets over the lifecycle of ownership in alignment with business needs.

This by definition involves change and where a procedural approach will go only so far. We argue that in order for successful change to take place it is essential to understand the social context in which this change is to take place. This is especially important if the change is going to require new decision making, new information processing, new knowledge pathways and ultimately new ways decisions are made across previous functional boundaries.

## Social Network

*People and the information on the relationships between them.*

## Informal Organization

*The empirically determined relationships that exist between people, as opposed to relationships that are implied by formal organizational structure.*

Within every complex organization there is the formal organizational structure that is apparent, charted, normally understood and provides a clear understanding of the hierarchy of structural alignments.

However, equally important are the informal structures that exist within organizations, which provide coherency, and at their best flexibility and nimbleness to address new situations. Conversely, these informal structures can overrule formal structures and become a hidden obstacle lurking unseen in the background preventing progress towards achieving objectives. It has been argued that the informal relationships among employees are often far more reflective of the dynamics inside a company. They are much more capable of describing how “work happens” than relationships established by positions within the formal structure (Cross et al. 2002a)). Figure 1 illustrates the crucial contrast between the formal and informal organization.

In anatomical terms, the formal structure has been compared to a skeleton and the informal structure to the central nervous system drawing together the collective thought processes, with the information flow and decision making patterns which create actions and reactions within organizations.

Attempting to create sustainable, meaningful, positive change requires the understanding of both the formal and informal structures within an organization.

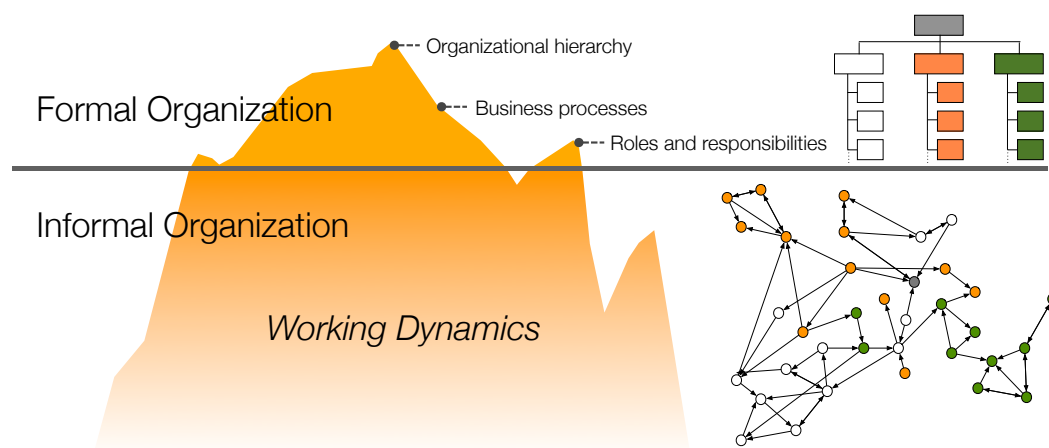


Figure 1: Formal vs. Informal Organization

Supporting our arguments, an extensive study by Neilson et al. (2008) found that streamlined information flows and clear decision rights are the core requisites for successful strategy execution (Figure 2). We are convinced that this is also applicable to asset management. In fact, understanding information flow and decision rights may be significantly more valuable than directly engaging in structural changes and establishing incentives in the hope that this will invoke the required change.

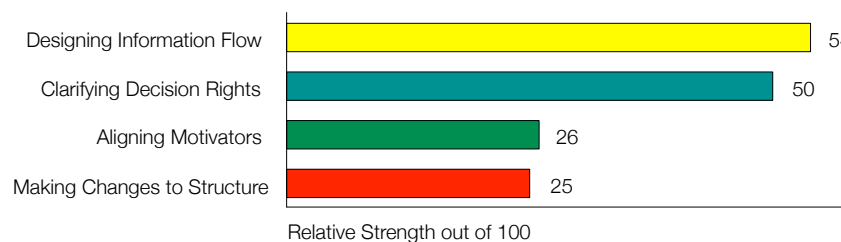


Figure 2: Building blocks of successful strategy execution.  
Adapted from Neilson et al. (2008).

## Social Network Analysis (SNA)

SNA is a methodology for determining and analyzing relationships between people in order to show how information flows and decisions are made; ultimately investigating how work gets done. This enables managers and teams to understand:

- Who the prominent players are, and whom others depend on to solve problems and provide technical information. To whom do people turn to for advice?
- The actual nature of the communication network in reality demonstrating how communications actually occur regarding work related issues, and who is central to these communications. This illustrates both informal collaborative relationships and holes within the structures.
- Whether sub groups emerged which are disconnected or partially connected to the core.
- Which individuals are isolated and limited in their roles or conversely who faces a situation of overload.

SNA is a means to analyze the informal organization beyond the organizational chart. The analysis allows managers and teams to visualize and understand the myriad of relationships that can either facilitate or impede information flows,

decision processes and knowledge creation. Thus, mapping opportunities and constraints in invoking change within the organization.

The purpose of this article is not to describe how to undertake such an exercise but rather to illustrate using real data the tangible benefits of understanding informal networks from an asset management and change management perspective. However, for the sake of completeness we will briefly discuss the data collection and analysis.

## Data Collection and Analysis

There are various ways to collect SNA data and construct networks. Fundamentally, SNA aspires to resemble the real interactions of a group of people. Therefore, we have to decide on questions as: Whom do we include in the analysis? How can we obtain data that resembles interactions and avoid measurement error? Do we want to consider the “strength” of relationships, if so, how? Do our decisions add value and is the analysis feasible? The works by Wasserman and Faust (1994) and Carrington et al. (2005) provide a detailed discussion about network measurement.

The case study presented in this article, was conducted at a mineral processing plant in, South Africa. The studied networks span the plant management, and the three major departments of production, engineering and the technical metallurgical department; the analysis does not include artisans. Throughout the study we tried to balance theoretical SNA considerations with pragmatism, focusing on added value for the partner organization. As a result, data collection by questionnaires only required 16.2 minutes per individual surveyed. The questionnaire asked questions in the form of “Whom do you receive work related information from”, where each interaction between two individuals was attributed with a frequency of interaction of either “hourly”, “daily”, “weekly” or “monthly”. Data processing led to the construction of three networks:

- Information exchange network
- Decision approval network
- Decision making advice network

The networks captured the plant’s informal working dynamics, delivering comprehensive insight into an array of potential constraints in asset management strategy execution.

Throughout the investigative process we warranted confidentiality to all research participants. On the one hand this protected individuals and on the other it promoted the integrity of data.

## Key Learning Number 1

### Mapping the Information Exchange Network.

The first exercise in the project was to map the information exchange network in order to understand the consistency or lack thereof. This would allow us to comprehend who is key to the system and has a high likelihood of becoming a bottleneck for the plant's information flows and conversely who is isolated from the information exchange network and is therefore isolated from making a contribution.

The information exchange network is illustrated in Figure 3. Nodes represent plant staff, so called actors, and each arrow represents an information exchange interaction between two actors, where the node that is pointed towards supplies information to the node at the origin of the arrow. The colour coding of each node represents what group the individual represents.

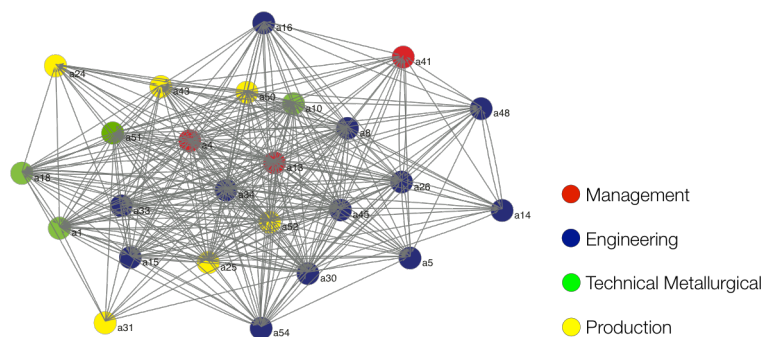


Figure 3: Information Exchange Network

A more revealing presentation of the network in Figure 4 shows the number of people each individual receives information from (outdegree) and passes information on (indegree). There are four quadrants depending as to where an individual is located. We refer to the individuals of each quadrant as Pivots, Sources, Outsiders and Seekers. A “Pivot” is a high intensity transmitter and absorber of information such as a13. In contrast a14 is secluded and a50 is a seeker absorbing large amounts of information. The crux of the matter is that the

central quality of pivots and sources is twofold. The high connectivity elevates these individuals into influential positions but with increasing requests by other network members they run the risk of becoming overloaded and turn into bottlenecks to the information flow.

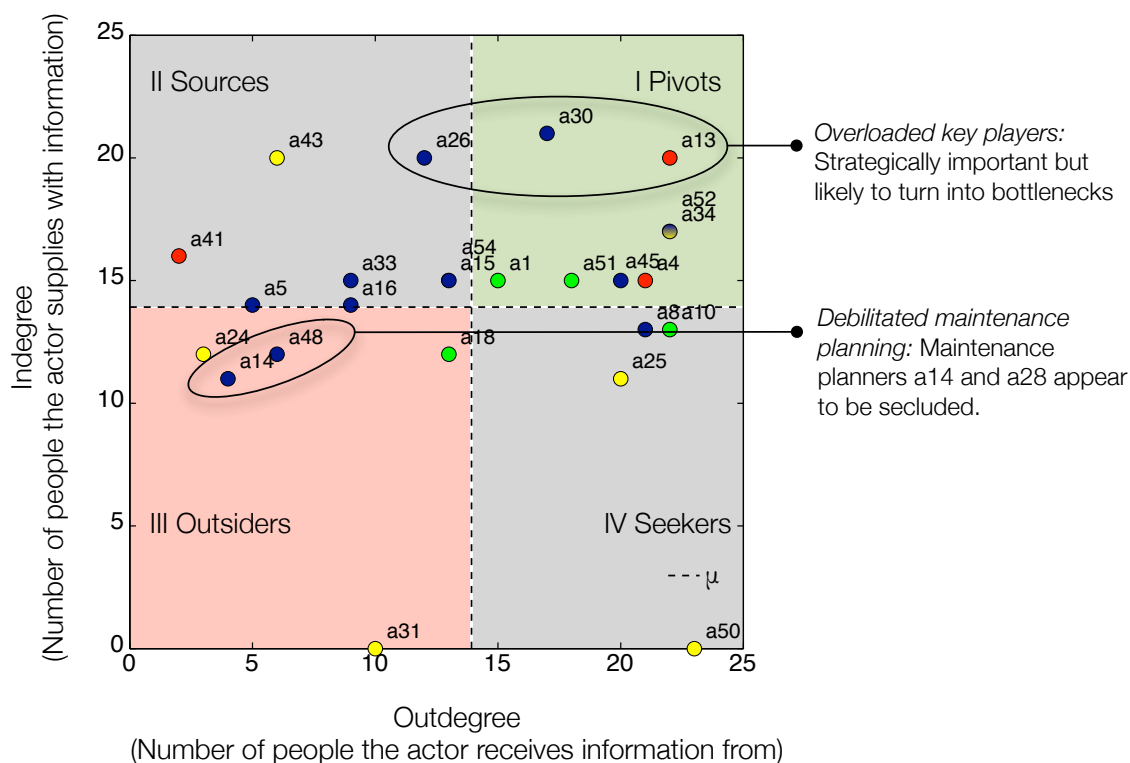


Figure 4: Illustrating the Involvement in Information Exchange

## Key Learning Number 2

### Mapping the Decision Approval Network

Key to any asset management or asset performance program is how decisions are made and who is making the decisions. This can be at the most fundamental basis when an artisan strips a unit and makes decisions as to how and the extent of the repair to the strategic where decisions are made as to the adjudication of priority and resources. The consequences of both good and bad decisions and the potential of ineffective “actors” making poor decisions or isolating expertise

from the decision making process prompted us to analyze decision making in this study.

The decision approval network is presented in Figure 5. On the X-axis we map the number of people an “actor” receives decision approval from and on the Y-axis we map the number of people an “actor” approves decision for. As with Figure 4 the colour of the indicator represents the group the “actor” belongs to.

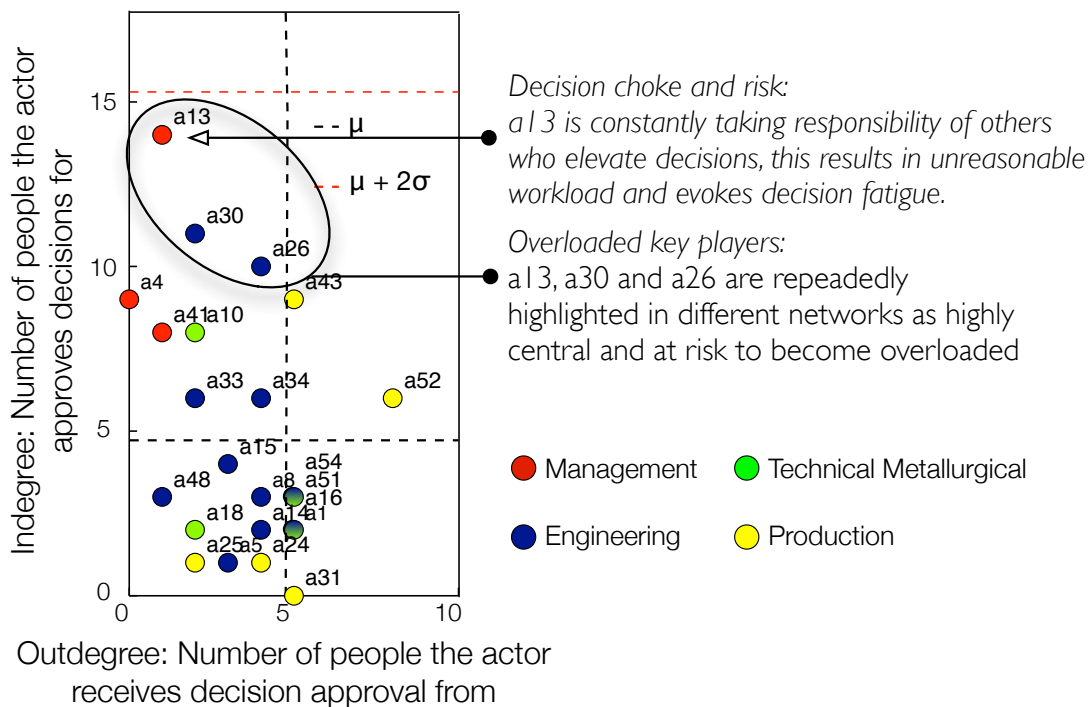


Figure 5: Illustrating the Network of Decision Approval

There are some immediate clear indicators of risk, which stand out in this mapping. Firstly we have the manager a13 who is approving a high number of decisions and receives very few completed decisions. This is a clear problem where a13 is carrying too high day-to-day workload with his subordinates shying away from making decisions. As a manager a13 has to have the time to manage and improve. With the current workload this is clearly going to be a challenge. The mapping shows that there is either something structurally wrong, or a13 is working at too low level.



Secondly actor a26 is from the technical (non management group) and is processing a significant number of decisions, while receiving a low number of “completed decisions”. Both, a13 and a26 have pivotal positions within the network and they are imperative for the functioning of the plant. The SNA suggests that these key players may be overstrained and need support. Additionally, a13 and a26 may be affected from what is termed decision fatigue. Research into decision-making shows that the quality of decision-making deteriorates with the number of decision that are made – so-called decision fatigue (Tierney, 2011). Research has shown that the simple act of making a decision degrades one’s ability to make further decisions. In other words the more decisions you make the poorer the quality of decision-making.

The SNA indicates a point of clear vulnerability. The appropriate management response would be to provide more finished work to these individuals, investigate the reasons for overloading and to recognise that overloading can be a choke point either holding up decisions or having a direct affect on the quality of decision making within the network.

### Key Learning Number 3 Strategic Collaboration at Risk

Figure 6 is known as a blockmodel. Each field in the blockmodel represents a relationship between two individuals, where the interaction frequency of information exchange is interpreted in a gray scale. The block model represents the network’s adjacency matrix that treats a selection of individuals as an aggregate social unit, termed block – within the studies context, these are the different departments. Here, each block indicates the information exchange habits between or within departments, where percentage values indicate the density of information exchange between two departments.

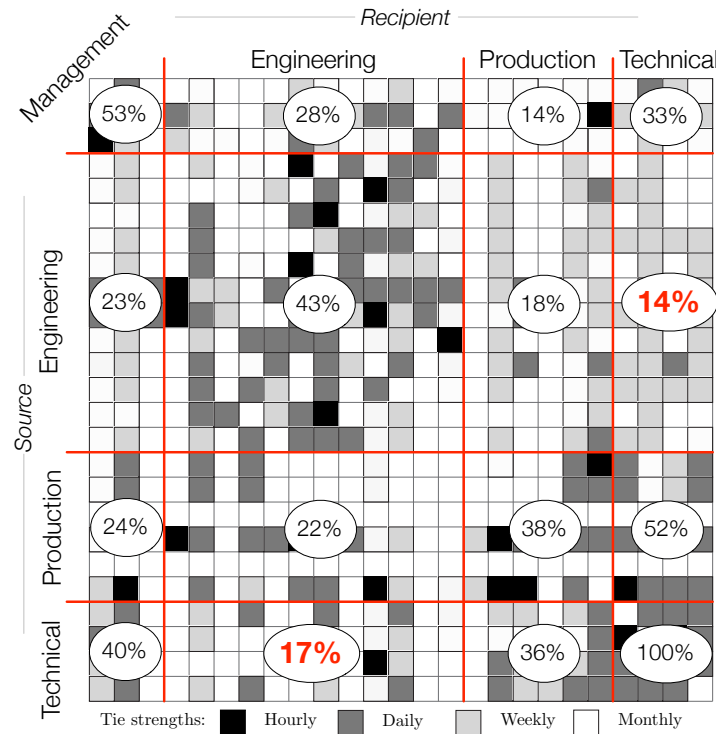


Figure 6: Interdepartmental Information Exchange

The block model reveals that the information exchange between the engineering and technical metallurgical department is the weakest interdepartmental relationship at the plant at 14% and 17% respectively. This is especially perilous for asset management because, in the case of this plant, improvement projects are supposed to be carried out in collaboration between these two departments. However, the informal networks clearly indicate a deficient partnership.

Secondly there is excessive cohesion within the engineering department, which is a function of the dysfunctional state of planning we discovered in Key Learning 1. This has forced engineers and supervisors into self-reliance and finding alternative solutions when coordinating maintenance tasks. This results in extra workloads, poor logistics, integration and a distortion of roles and responsibilities. The effects are visible in the next Key Learning Point.

## Key Learning Number 4

### Effects of Ineffectual Maintenance Planning

Analysis of the decision-making processes indicates a so-called strong component within the plan's network, illustrated in Figure 7. The strong component is a highly connected sub-network that exists within the plan's entire network. It indicates a close linkage between individuals where every arrow indicates an approval request for a decision. The multiple bi directional arcs indicate mutual dependencies in decision approval between individuals.

The learning here is there is not a clear designation of decision rights which addresses the issue of who has the rights to decision approval. The lack of clarity leads to both delays in decision making, and potentially the inappropriate person making the decisions. The recommendation here would be to clarify the business processes to ensure the effectiveness and appropriateness of decision-making.

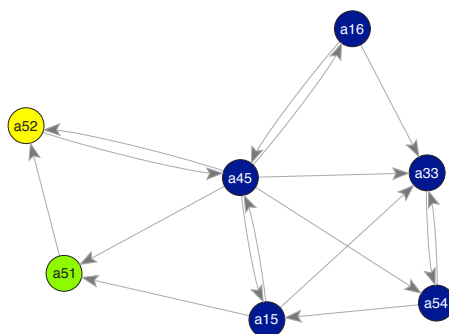


Figure 7: Illustrating Unhealthy Bi-Directional Decision Making

## Limitations

Network data was collected via questionnaires and is dependent on individuals being open and candid in their feedback. In order to achieve this as best as possible, staff were openly engaged in understanding the goals of the project, and were given a guarantee of confidentiality. An attempt was made to show the

benefits of understanding the social network with regards to both systemic and individual contributions that an optimized network could provide.

The confidentiality element of the study may have limited some of the outcomes, but it ensured the integrity of inputs and ultimately provided for a successful and well-accepted set of conclusions that the teams agreed with. This agreement is the first point of creating a foundation for change.

## Conclusions

This article represents the core findings of a research project into the application of social network analysis within the asset management environment. The results have exceeded expectations in that with a refinement of method we were able to get rewarding results quickly.

In summary we were able to learn:

1. About the cross-functional and informal dynamics at the plant.
2. How the organization makes decisions formally and informally.
3. Who was connected to information flows, and who was isolated and needs to be drawn back into the network.
4. That a manager is overloaded due to subordinates who shy away from their responsibilities and frequently elevate decisions.
5. That the decision approval network showed up inefficiencies in decision making, which with an adjustment to the business processes could be corrected.
6. That the partnership between two departments requires attention to ensure the success of future asset management initiatives
7. Additionally we clearly illustrated that the work management (planning and scheduling) function was ineffectual and was being compensated by engineers and supervisors taking alternative corrective actions overburdening their responsibilities.

SNA is an effective tool in change management as it has the ability to highlight some of the barriers before they obstruct asset management aspirations. Understanding the informal networks of a plant can be the first step towards removing barriers to change by pinpointing them. We therefore conclude that SNA as an asset management tool will strongly support execution efficiency.

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