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## Manufacturing's Wicked Problems (Partially) Explained Through Social Network Analysis

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# Manufacturing's Wicked Problems (partially) explained through Social Network Analysis

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## Abstract

This paper reports on an empirical case study based in a UK manufacturing company which was striving for more effective employee engagement. Social Network Analysis (SNA) was used to investigate the situation through a consultative approach involving the workforce in a structured debate about employee engagement and its possible effects upon the organisation. The paper reveals how employee engagement varies depending upon the characteristics of an individual and how they interact with other employees.

## Introduction

This paper explores a UK manufacturing firm (ManufCo) riddled with a wicked problem (WP); namely that of poor employee engagement. Wicked problems are considered to be complex, systemic issues with multiple causes and contradictory interdependencies that span organizational, operational and professional boundaries and are often wholly unsolvable whilst being improvable (Conklin, 2005). Rittel and Webber (1973) suggested that WPs are not well understood, often having elusive and unpredictable solutions. Wicked problems have also been described as 'messy' (Ackoff, 1974) and 'unstructured' (Mintzberg *et al.,* 1976). The characteristics of a wicked problem were observable in this case study in respect to their employee engagement (Allen et al., 2007).

While wicked problems are recognised to exist in different applications across many disciplines, the literature is less certain on what can be done about them. Literature

suggests that employee engagement can assist problem solving - as understanding the structure of informal working relationships is beneficial to the enhancement of employee engagement in everyday operations and special initiatives.

This research has investigated wicked problems using Social Network Analysis (SNA). Specifically; it examined how employee engagement was achieved (or not), as SNA is concerned with the structure and patterning of a system of people or objects linked by relationships, sometimes also aiming to identify their causes and consequences (Tichy et al., 1979) and so can be used as a way of making sense of informal relationships between people and problems in a wicked problem scenario (Allen et al., 2007); thus SNA was chosen as an approach for this research

ManufCo (name disguised) is the case company; it was a UK contract manufacturer with a 100 years history. It produced a range of high quality personal-care products for well-known luxurious brands and had an annual turnover of approximately £10 million. Fifteen years ago, an Asian-based conglomerate acquired ManufCo and continued investing in it even though it had not been profitable in recent years. In 2009, to assist its turnaround, the Managing Director and a Manager were seconded to ManufCo from the headquarters and a new local Managing Director was appointment in 2010 which kicked off attempts at a major company turnaround.

## Employee Engagement Literature

Saks (2006, p.601) observed from the literature that employee engagement can be defined as "emotional and intellectual commitment to the organization" (e.g. Shaw, 2005) or "the amount of discretionary effort exhibited by employees in their job" (e.g. Frank et al., 2004). For Seijts and Crim (2006), an engaged employee is fully involved in, and enthusiastic about, his or her work. Harter et al. (2002) suggest it refers to the individual's involvement and satisfaction with as well as enthusiasm for work. There is also the psychological side of engagement. Schaufeli and Bakker (2004, p.295) define engagement as "a positive, fulfilling, work-related state of mind that is characterized by vigor, dedication, and absorption". Macey and Schneider (2008) summarised a representation of the construct via four main approaches: first, as a psychological state indicating commitment; second, as a personal disposition or trait; third, as manifested positive behaviour; and fourth, some combination of the three. Research by Robinson et al. (2004) found that engagement was closely linked to feelings and perceptions around being valued and involved. With Kahn's (1990, p.694) well-cited definition of "harnessing of organizational members' selves to their work roles", he saw engagement as how an individual, through psychological conditions relating to meaningfulness, safety and availability, perceived his or her work context and how that influenced his or her willingness to engage with work roles. As further explained by Rich *et al.* (2010, p.620), "Perceptions of organizational and work factors related to tasks and roles are the primary influences on psychological meaningfulness; perceptions of social systems related to support and relationships are the primary influences on psychological safety; and self-perceptions of confidence and self-consciousness are the primary influences on psychological availability". Thus employee engagement can be seen as a possibly complex collection of these different perceptions which can be manifested cognitively, emotionally or physically to varying degrees. Also, it can be seen to exist through group processes of shared mental models and collaborative work behaviours (Saks, 2006).

Saks (2006) describes two forms of engagement – engagement with one's job and immediate work environment, or engagement with the organization as a whole. These usually involve notions of reciprocity or transaction, for example, the actions of one party lead to a response or actions by another party. He concludes, "…employees who

perceive higher organizational support are more likely to reciprocate with greater levels of engagement in their job and in the organization" (ibid, p.613), with greater incidence of positive attitudes, intentions, and behaviours. This view is shared by Cropanzano and Mitchell (2005), who found that when individuals received economic and socio-emotional resources from their organization, they felt obliged to respond in kind to repay the organization.

It follows that having engaged employees can collectively lead to beneficial outcomes for organizations too. Practitioners, including those at ManufCo, are therefore understandably interested in how employee engagement can be modulated and moderated to improve organizational outcomes. Indeed, many studies have found positive correlations between engagement and meaningful organizational outcomes. For example, Harter et al. (2002) found performance measures like productivity and turnover were influenced by engagement levels, while Schaufeli & Bakker (2004) correlated engagement negatively to intention to quit and positively to organizational commitment. Ram and Prabhakar (2011), when researching Perceived Organizational Support, found that employee engagement positively correlated with favourable organizational outcomes, which include job satisfaction, organizational commitment and performance.

From the literature, there are clear implications for employee engagement in the organizational context, and these may be manifested in both the formal and informal employee relationships within organizations. However, concerns have been raised that research on engagement in the organizational context is still lacking. This case study makes a contribution in that area.
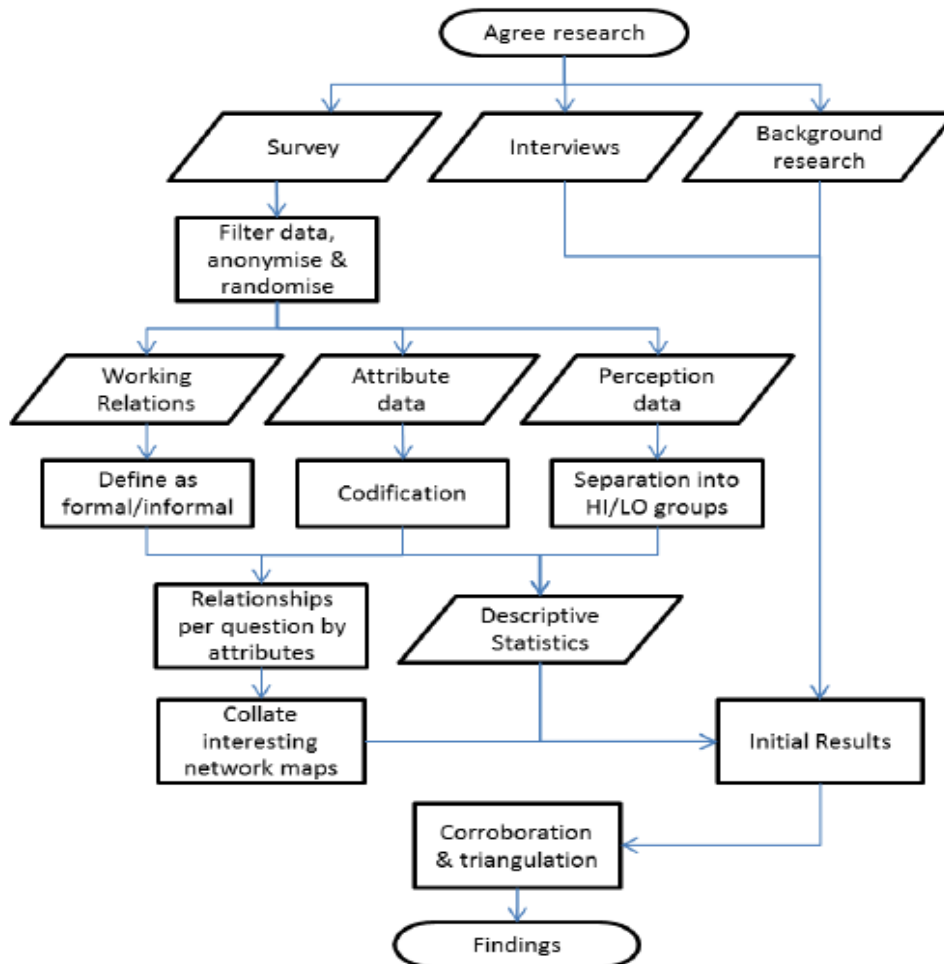
**SNA Methodology**

SNA was conducted in ManufCo - around half of the 168 people employed were engaged in the study across five different organisational strata. Two groups of employees were examined, highly engaged (HI) and not highly engaged (LO) in workplace social networks – the level of engagement was determined by their participation and performance in company training and initiatives. Employee engagement level was then correlated to their personal characteristics and informal influence networks through SNA. Figure 1 outlines the overall research methodology.

Social network analysis, a specialist technique which combines elements of qualitative and quantitative techniques through the graphical display of relationships, was used to explore the data. In addition, results from analysis of documents as well as findings from informal discussions and interviews were employed to corroborate the findings from SNA, building up a better understanding of the case.

SNA allows the visualisation of relationships, drawn graphically as circles (each representing an employee identifiable by the alphanumeric codename) joined by lines (representing working relationships between individuals) using Gephi 0.8 beta (see Figure 2). The empirical data collection began with a survey; the questions asked are given below:

1. Who do you work with, on a day-to-day basis?
2. Regarding the change programme, who do you talk about it with on a general basis?
3. Who comes to you for advice on issues relating to their work?
4. Who do you seek advice from on issues relating to your work?
5. Thinking about your day-to-day work, who do you currently work with to ensure timely completion of your activities?

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6. Thinking about your day-to-day work, who should you work with to ensure timely completion of your activities?
7. If you have an idea for improving a certain aspect of work, who do you talk to about it in general?



*Figure 1 - Study Methodology*

For each question asked in the survey, a network of employee interactions was constructed. Circles and lines were shown in different colours to represent different attributes as desired. In this research, each circle was colour-coded according to their type of department (e.g. Operations - blue, Ops-linked - green or Support functions - red). Lines were coloured brown for the formal links and informal links were coloured light blue, as shown in Figure 2. The sizes of the circles were adjusted to reflect the weight of any one attribute of an individual, allowing attributes to stand out visually. For example, for length of service, the larger the circle, the longer time the employee had been with the company. The graphs were plotted several times per question against each person attribute.
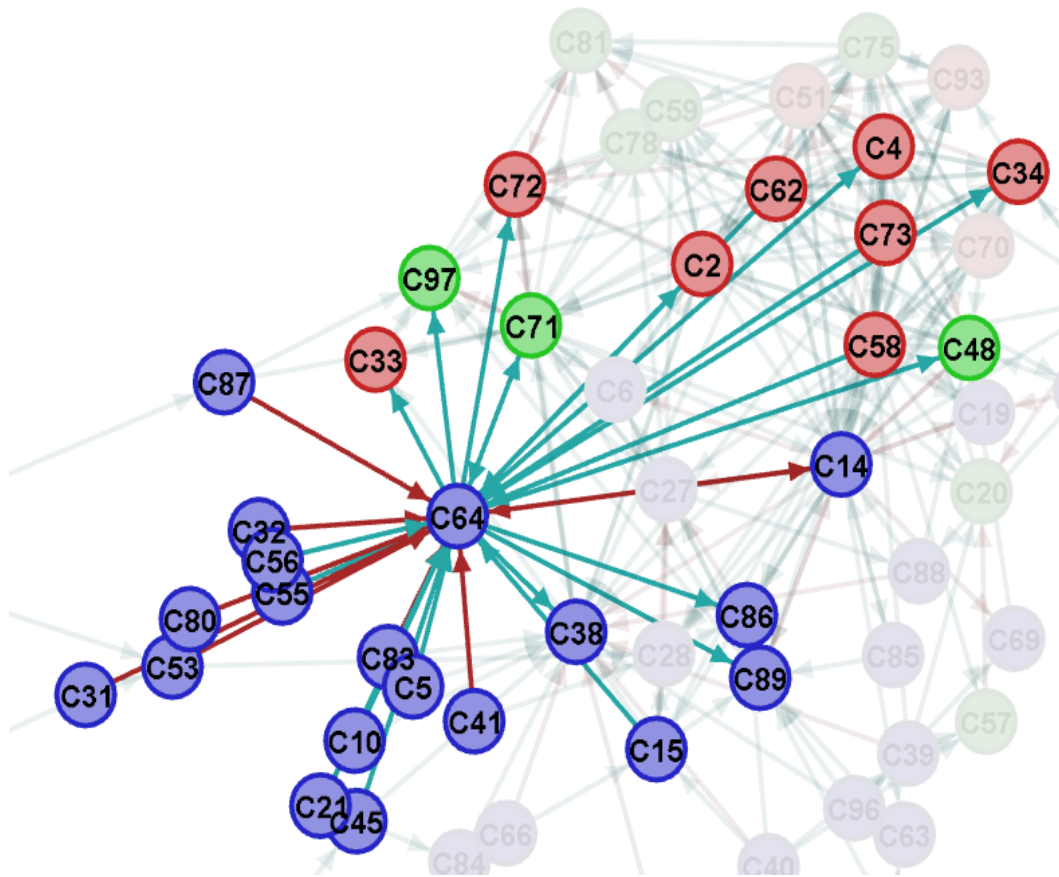
*Figure 2: Example of an SNA output map (from Gephi 0.8 beta)*

A visual assessment of the network and review of its quantitative properties demonstrates how the network operated, and if certain links might indicate trends which may be pertinent or suggest explanatory behaviour. Figure 2 is a generic example of pattern-matching, one of 5 analytical techniques suggested by Yin (2009) in case study research. Graphs of HI and LO employee networks were placed side by side and compared for each question to see if differences could be identified. Quantitative measures of SNA were used in this research as adapted from Scott (2000) and Wasserman and Faust (1994); such as degree of connectivity, mean degree of connectivity, density of links in relation to maximum density and inclusivity.

## Results

Several interesting observations were made in the case of ManufCo. Firstly, the company had recognised that it was not addressing its wicked problem of employee engagement adequately, and that driving attitudinal change was an important first step. However, ManufCo had gone ahead with change whilst not having understood the full picture behind the current issues around engagement. Without that, it could not accurately target the change programme. As a result the senior management team employed a one-size-fits-all approach, with employees having no choice over which part of the organisational change programme (e.g. specific training initiatives) they were assigned to. Some employees lost interest in the programme, even if they did recognise that the training could be beneficial. It was not surprising that staff engagement at ManufCo did not perceive much successful change occurring.

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Employee perceptions of the change programme were mixed at best, with some staff clearly sceptical of the benefits of the change programme. Looking at the survey data, most employees seemed to recognise the importance of the change programme to their own work, and most also reported good perceived support from the senior management team. However, this was not consistent with the aforementioned qualitative findings, which veered towards the negative. Adding weight to this negative view was the finding that even amongst the highly engaged group, the level of interest of staff in their assigned training modules was variable.

An overall understanding of the engagement situation was derived only after subsequent findings concerning working relationships were explored. One of the strongest indications of whether the change programme was effective at forging engagement was the amount of talk it generated. Given the visibility and the reach of the change programme, the programme would be expected to feature highly on employee's minds and find its way into regular conversation. However the data showed at best a muted response among employees – there was very little talk among staff about the change programme (out of the 7 questions, Question 2 registered the lowest number of links for both groups). A lack of communication in the organization had also been cited numerous times. Part of this was perhaps down to staff attitudes. For example, the Managing Director of ManufCo felt that "those who felt they should be communicated to, did not feel a need to communicate to others". Another part of this, however, could also have been due to a lack of proper channels of communication for staff to engage with Management. One suggestion for the senior management team of ManufCo was not to concentrate uni-directionally on providing justifications for the change programme in a top-down manner. Rather, they should ensure effective lines of communication were open for staff to feedback their thoughts to Management, especially as the change programme gathered momentum.

Main differences between highly engaged (HI) and less engaged (LO) staff are shown in Table 1, the highly engaged group composed of employees with a higher level of education attainment, suggesting that they were perhaps more attuned to understanding the need for change and the way Management communicated (whose lexicon could be perceived to contain more 'business speak' than 'everyday language' which shop-floor employees might be more familiar with). The highly engaged group also typically comprised employees working at a more senior level in the organization, which backed up the point regarding familiarity of lexicon. Employees working at a lower level thus perhaps understood less of the wicked problem facing ManufCo, and therefore were less engaged as they did not fully grasp the need for change or the gravity of the situation.

| Characteristic | Observations | |
|---|---|---|
| | Highly engaged group | Less engaged group |
| Education | Propensity towards higher attainment e.g. university degree | Propensity towards lower attainment, most employees had secondary school qualifications |
| Level of seniority | Composed of more senior employees | Greater proportion of junior employees and operatives |
| Number of years in current role | Longer time spent in current role (*not* total length of service) | Employees had been in post for 2 years less on average |

*Table 1: Summary of differences between the highly engaged and less engaged groups*

However, there could also have been some bias in the responses received. Senior employees could have reported more favourable perceptions by virtue of the fact that they were involved with the running of the business and felt that they had to, for various reasons, be seen to be supportive. This viewpoint was supported by the finding that even among the highly engaged group, the level of interest in the assigned training module was variable, with some well-linked (and hence influential) employees reporting no interest in their assigned training as part of the overall programme. It seemed contradictory that employees were on one hand not fully interested in their current training module, yet could still feel that the change programme (of which the training modules were an integral part of) was important in helping them do their jobs better. To fully understand this apparent cognitive dissonance, more research was done in focus groups understand why employees felt the way they did about their training module. Finally, looking at the number of years spent in their current role, highly engaged employees had, in general, been in post longer than less engaged ones (by around 2 years more). This could be seen to be counter-intuitive as newer or fresher employees could potentially be more open to change. Perhaps this was a reflection of the fact that the longer-serving employees had grown more attached to the firm; and were perhaps therefore more supportive of the change programme.

It might seem logical that people who had been in post for a long time were more experienced and therefore more likely to be consulted. However this had not been found to be the case. Perhaps roles were rather specialised so the longest-serving employee might not be the most qualified.

Furthermore, perhaps experience was not particularly valued in ManufCo. It has been mentioned that the company culture did not really reward staff for their efforts, so perhaps people did not have the incentive to seek out their most knowledgeable colleagues, but rather relied on what was convenient. Supervisors should have been made more accessible and be more approachable for advice – this was one area where perhaps supervision (or access to supervisors for advice) could improve timely deliver. Further specific details are given in the Appendix which contrasts the employee engagement levels (HI and LO) against various personal attributes on the survey respondents.

## Conclusions

ManufCo was experiencing problems on many fronts, which were complex and inter-related. Those problems can be classified as consisting of financial-related, capability-related and human-related, as defined in Figure 3. ManufCo had suffered from declining market share and sales, escalating costs, inconsistent quality and delivery track record, aging infrastructure, poorly trained staff, questionable leadership, inappropriate IT systems and lack of investment in new products and services. Also the motivation of much of its workforce was low and culture was unprofessional. The official communication channels in the company were less effective than the unofficial ones and human resource planning was not seen as significant. Health and safety issues had also played a negative part for the organisation.

As the theory on employee engagement suggests that improving employee engagement may possibly improve these, as a root cause behind potential failure in these aspects, then ManufCo hoped to improve them by strengthening its employee engagement through its overall programme of improvement. Further details about how this occurred or failed to occur are available from the authors.
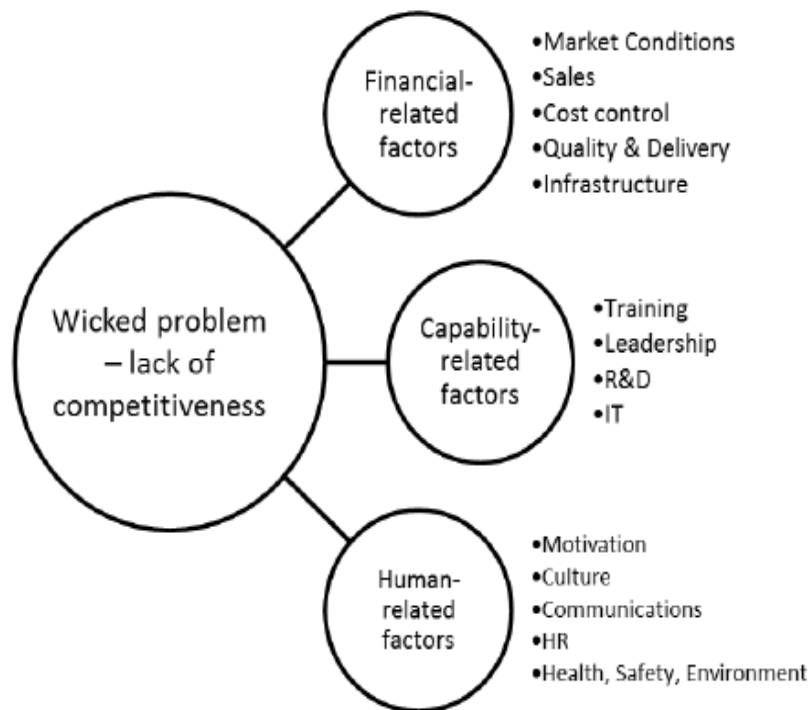
*Figure3*: *ManufCo's Wicked Problem*

In summary, at a high level, the generalizable findings unspecific to the case company are believed to be:

A. Effective communications are instrumental to wicked problem alleviation but not sufficient without other organisational initiatives

B. Better understanding about an organization from a social network perspective may promote the chances of success in wicked problem (specifically employee engagement) alleviation

C. A network approach using Social Network Analysis may provide indicators of poor employee engagement

D. Social network analysis can improve understanding of employee engagement, especially in the presence of conflicting data

E. Social network analysis can aid the understanding and identification of employee characteristics which may influence employee engagement in an organization

F. Greater use should be made of social network analysis as an engagement tool to assist wicked problem alleviation in organizations

G. In alleviating wicked problems, more focus should be placed on how informal organisational networks can support engagement activity.

This research does not claim that these findings are universally true, but do claim to have supporting evidence from a single in depth company case study.

## References

Ackoff, R. L. (1974), *Redesigning the Future: a systems approach to societal problems,* NY, Wiley.

Allen, J., James, A. D., & Gamlen, P. (2007), "Formal versus informal knowledge networks in R&D: a case study using social network analysis', *R&D Management*, Vol. 37, No. 3, pp.179–196.

Bakker, A. B., & Schaufeli, W. B. (2008), "Editorial - Positive organizational behavior: Engaged employees in flourishing organizations", *Journal of Organizational Behavior*, Vol. 29, No. 2, pp.147–154.

Conklin, J. (2005) Wicked Problems and Social Complexity. Chapter 1 in *Dialouge Mapping: Building Shared Understanding of Wicked Problems*. p1-25. John Wiley & Sons. NY, USA.

Cropanzano, R., & Mitchell, M. S. (2005). Social Exchange Theory: An Interdisciplinary Review. Journal of Management, 31(6), 874–900.

Frank, F. D., Finnegan, R. P., & Taylor, C. R. (2004). The race for talent: retaining and engaging workers in the 21st century. Human Resource Planning, 27(3), 12–25.

Harter, J. K., Schmidt, F. L., & Hayes, T. L. (2002). Business-Unit-Level Relationship Between Employee Satisfaction, Employee Engagement, and Business Outcomes : A Meta-Analysis. Journal of Applied Psychology, 87(2), 268–279.

Kahn, W. A. (1990). Psychological Conditions of Personal Engagement and Disengagement at Work. Academy of Management Journal, 33(4), 692–724.

Macey, W. H., & Schneider, B. (2008). The Meaning of Employee Engagement. Industrial and Organizational Psychology, 1, 3–30.

Mintzberg, H., Raisinghani, D., & Theoret, A. (1976), "The structure of "unstructured" decision processes", *Administrative Science Quarterly*, Vol. 21, No. 2, pp.246–275.

Ram, P., & Prabhakar, G. V. (2011). The role of employee engagement in work-related outcomes. Interdisciplinary Journal of Research in Business, 1(March), 47–61

Rich, B. L., Lepine, J. A., & Crawford, E. R. (2010). Job engagement: Antecedents and effects on job performance. Academy of Management Journal, 53(3), 617–635.

Rittel, H. W. J., & Webber, M. M. (1973), "Dilemmas in a General Theory of Planning", *Policy Sciences*, Vol. 4, pp.155–169.

Robinson, D., Perryman, S., & Hayday, S. (2004). "The drivers of Employee Engagement". Institute of Employment Studies. Report 408.

Saks, A. M. (2006). Antecedents and consequences of employee engagement. Journal of Managerial Psychology, 21(7), 600–619.

Schaufeli, W. B., & Bakker, A. B. (2004). Job demands, job resources, and their relationship with burnout and engagement: a multi-sample study. Journal of Organizational Behavior, 25(3), 293–315.

Scott, J. (2000). Social Network Analysis: A Handbook (2nd ed.). London: Sage.

Seijts, G. H., & Crim, D. (2006). What engages employees the most or, the ten C's of employee engagement. Ivey Business Journal, (April), 1–5

Shaw, K. (2005). An engagement strategy process for communicators. Strategic Communication Management, 9(3), 26–29.

Tichy, N. M., Tushman, M. L., & Fombrun, C. (1979), "Social Network Analysis for Organizations", *Academy of Management Review*, Vol. 4, No. 4, 507–519.

Wasserman, S., & Faust, K. (1994). Social Network Analysis: Methods and Applications. Cambridge: Cambridge University Press.

Yin, R. K. (2009). Case Study Research: Design and Methods (4th ed.). California: Sage.

| Question | Overall observations (applies to both groups) | Differences between highly engaged (HI) and less engaged (LO) groups | Characteristic | Specific observations and implications — Highly engaged group (HI) | Less engaged group (LO) |
|---|---|---|---|---|---|
| **Q1 Who they work with day-to-day** | This is the full collaboration network (used as benchmark for other questions) | HI was composed of more individuals, but had less total links than LO. In HI, some senior staff did not have any formal linkage with colleagues. | *(a) Years in current role* | – | Well-linked individuals were newer to their roles |
| | | | *(b) Interest in current training module* | Some well-linked individuals had no interest at all | – |
| **Q2 Who they talk with about the Change Programme** | Little talk among staff about the programme. Significantly lower level of inclusiveness — isolated individuals were from Operations. | Significantly lower mean number of links in LO — on average they talked to less than 1 colleague about the programme | *(a) Number of links to others* | Good cross-functional communication | Very low talk among Operations staff; many were isolated |
| **Q3 Who seek them for advice** | Significantly lower level of inclusiveness | | *(a) Number of links to others* | Good cross-functional communication | 2 individuals in Operations prominent |
| | | | *(b) Years in current role* | Most people approached were fairly new to their role | |
| **Q4 Who they go to for advice** | – | Advice network in HI was larger than that in LO. LO employees were less likely to be able to access advice from a diverse range of people. | *(a) Number of links to others* | Good cross-functional communication | Most advice-seeking occurred within functions |
| | | | *(b) Educational Attainment* | Greater communication among employees with higher attainment | – |
| | | | *(c) Interest in current training module* | A few well-linked employees were not interested – could have detrimental effect | – |
| | | | *(d) Level of seniority* | More senior employees were approached more often | |
| | | | *(e) Length of service* | Longer service did not mean greater tendency to be approached for advice | |
| **Q5 Who they currently work with to ensure timely delivery** | Lower informal linkage as compared to Q1. No major differences showed up between current state of working and desired state of working. | LO employees collaborated less on work pertaining to on-time delivery. LO appeared to desire more cross-functional working. | *(a) Number of links to others* | Key connectors in this case were similar to those for Q1 (day-to-day working) | |
| **Q6 Who they should work with to ensure timely delivery** | | | *(b) Number of links to others* | – | One employee, C73, became more prominent in the desired co-operation network |
| **Q7 Who they talk to when they have an idea for improvement** | Generally quite low number of links | LO reported half the number of links as HI. LO had much lower proportion of informal links | *(a) Number of links to others* | Significant proportion of formal links – more working together with line managers/direct reports | Distinctly split into 2 groups, mostly along functional divisions |