

Measuring return on human investment in quality improvement networks

Social systems consist of structure and organization. Structure in social systems are the people in the network of conversations collectively coordinating their collective actions. Organization refers to their conversations. I cannot understand the structure of social systems until I understand the organization of social systems. And why do I feel it is important to understand structure?

Humberto Maturana has described living systems as structurally determined systems, so everything that happens in the system is determined by the systems' structure. This is my old car, a diesel. It too is a system. The structure includes tires, steering wheel and fuel. I can change the structure by pouring vegetable oil into the fuel tank and the car will still run. But if I change the structure by pouring gasoline into the tank, the system breaks down and the car no longer runs.

When someone asks, "*How is your new car?*", and we answer, "*It broke down.*", we are explaining how



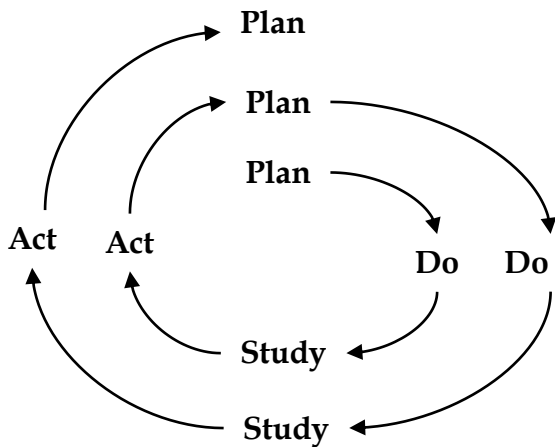
changes in the car's system left us with a car that quit operating. In order for the car to run again we fix the part of car, or structure that led to the break down. This is a simple example of structurally determined systems.

Wobble

In 1994 I brought social action research into a company manufacturing bar code devices. While touring the manufacturing facility, I learned that the workers were concerned about their

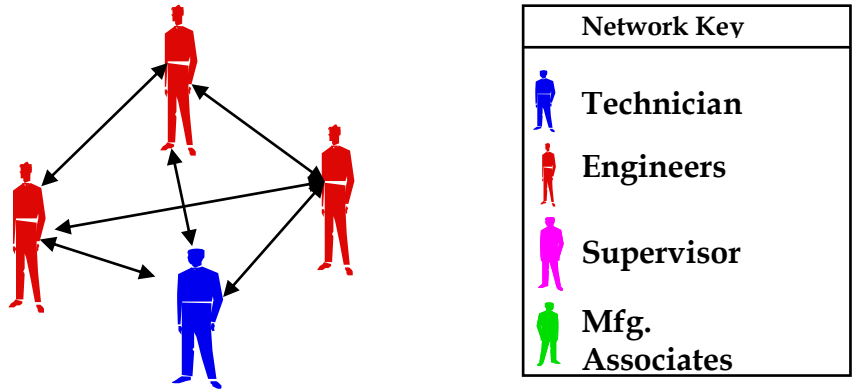
assembly process. When the hand-held laser motor shaft was glued into the laser motor, the laser light was pointed at a simple measurement card. Occasionally, the laser light would “wobble” jumping outside the measurement tolerances. When this happened, the entire assembly was thrown into the waste. Often the assemblers had to work late or over the weekend to meet production goals.

I was familiar with the continuous quality improvement cycle that Deming described as a spiral, showing his understanding of recursion.

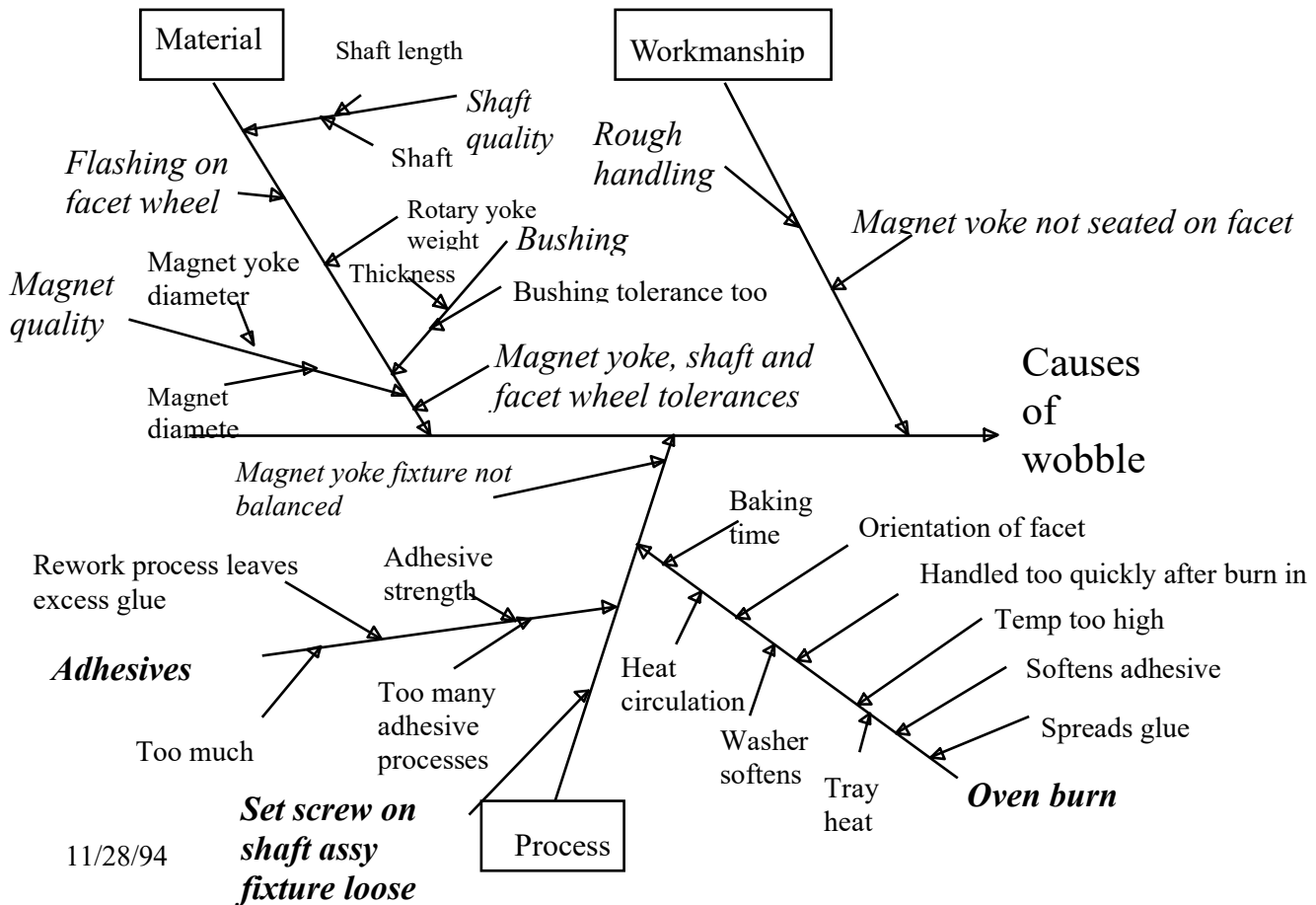


I was curious. Spending time on the assembly line, I could tell that the assemblers or manufacturing associates knew their product. I could also see that there was no quality improvement data posted. Using the same method for studying social networks I

had at the University of Oregon, I sent out a survey asking, “With whom do you study laser motor wobble?” Mapping the social network, I discovered that only engineers and technicians were studying the problem.



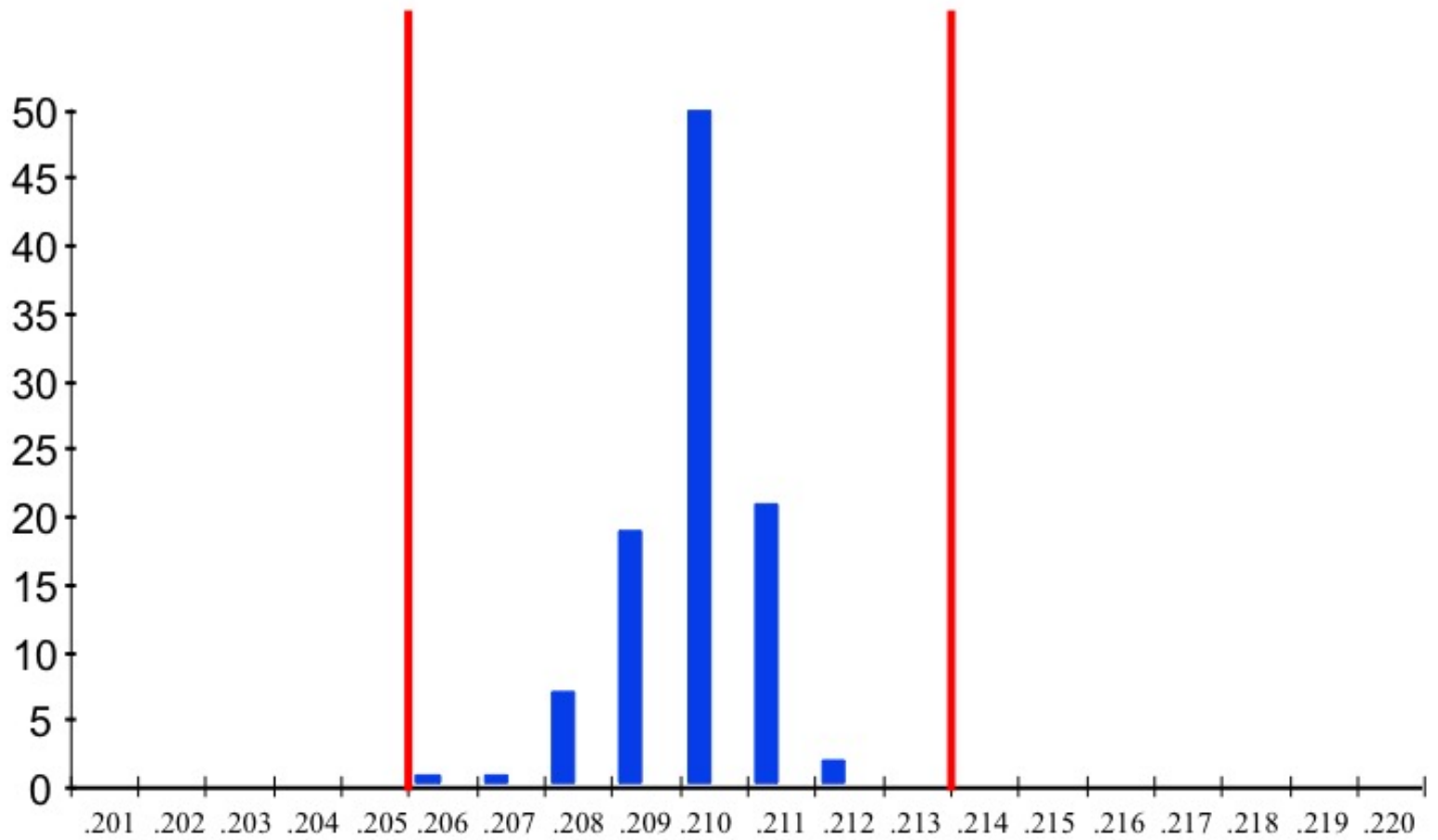
The social network mapping showed a collaborative social network but what was missing? The Manufacturing Associates I was working with. After deliberations between the Director of Manufacturing and the Director of Engineering we received conditional approval for the



Manufacturing Associates and I to study wobble. The conditions were that we would take no work time to coordinate our efforts and we would have no negative impact of the productivity of the assembly area. The culture as a network of conversations coordinating collective actions changed. We were changing the structure of the culture. We put up a bulletin board and began posting our work. The first thing we did was to map out the assembly as a system.

The map guided our data collection and decision making. We started with material. All of the parts for the scanner had quality tolerances. The Manufacturing Associates team decided to study the length of the bushings. I collected the data and couldn't help but notice the disrespect from engineering. I'm sure many were the laughs at our expense. Nonetheless, the bushing length met specifications.

Bushing Length $.210 \pm .004$



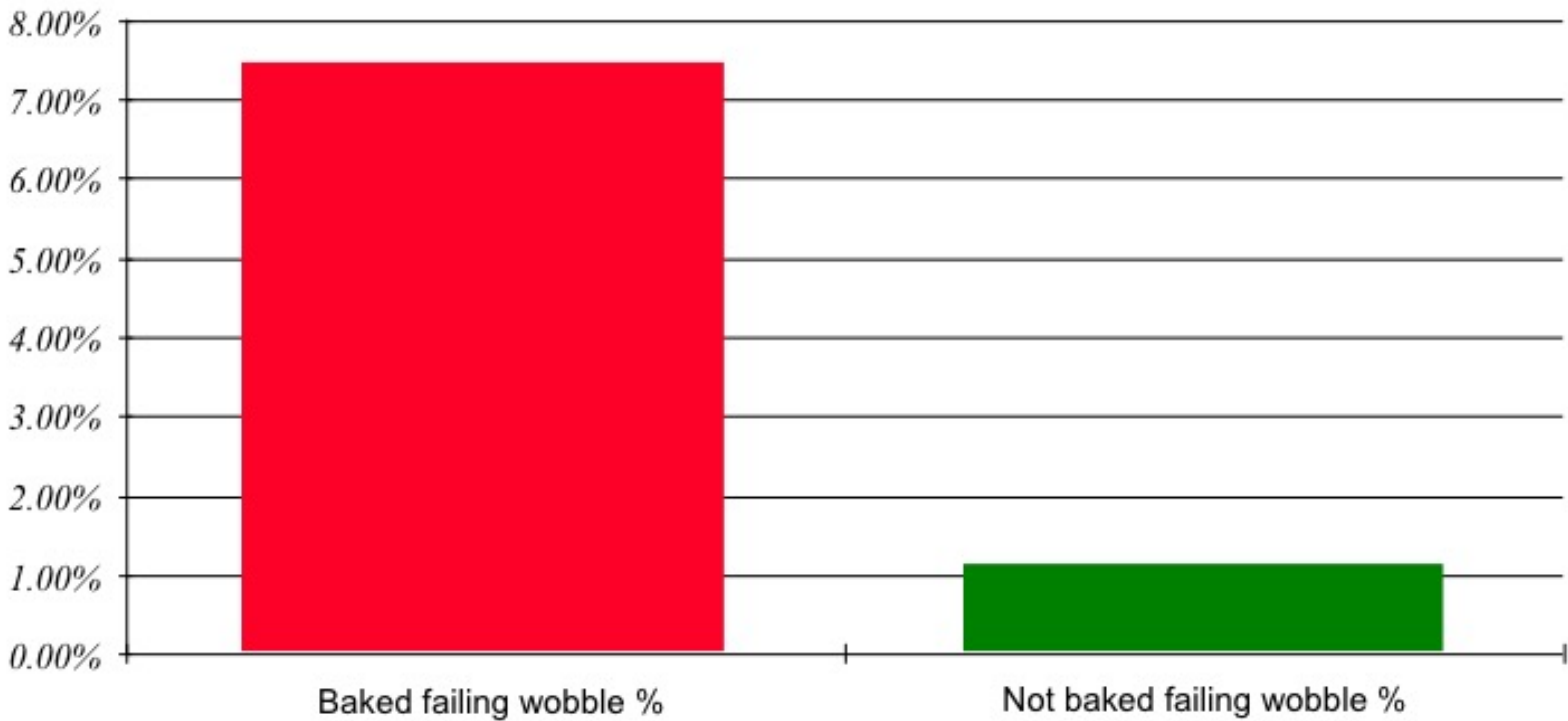
I posted the data on our bulletin board. Because we couldn't discuss data while working so we ended our breaks with a quick discussion guided by data and decisions as to where to go next.

Phou, an otherwise quiet soul, presented his idea – “Perhaps the baking process used to accelerate the hardening of the glued shaft to the laser motor was the source of wobble.”

Once again, we waited for senior managers to give us permission to alter the existing assembly process, a measure of productivity loss. Once permission came, we ran Phou's experiment.

Some assemblies were run through the normal baking process while another sample was not be baked, but air dried.

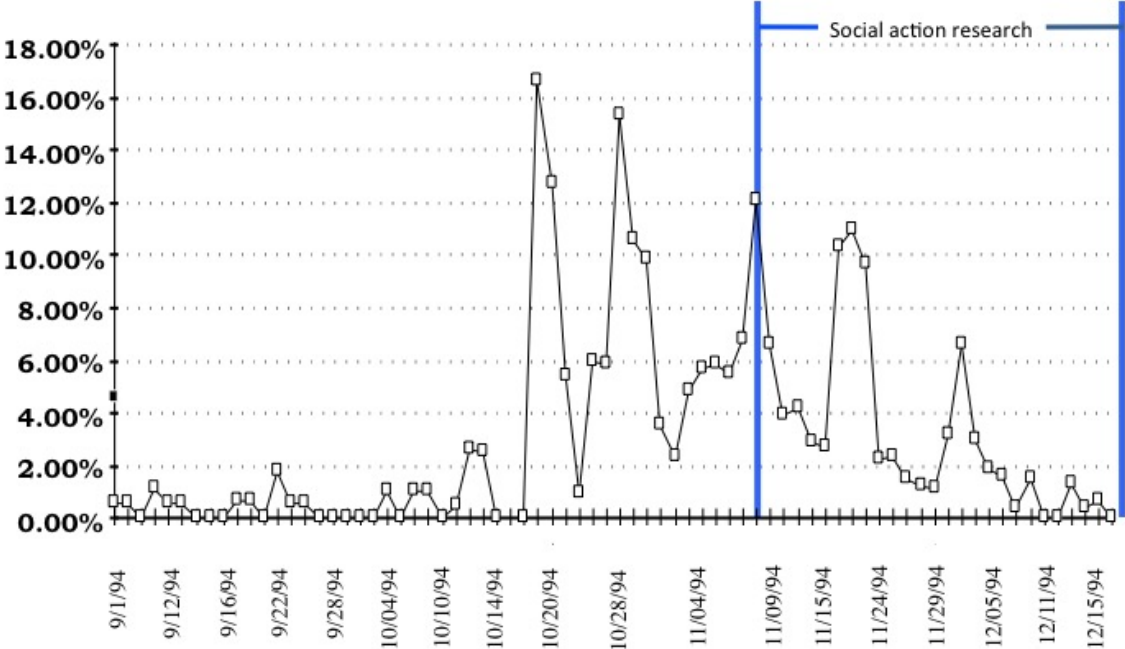
Effects of baking on wobble



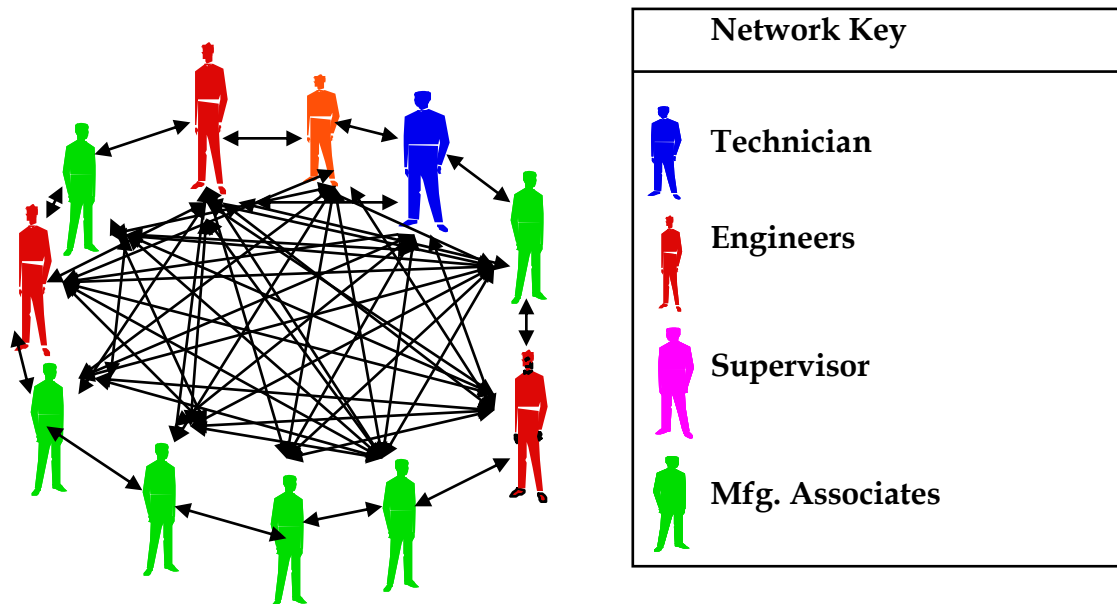
The Manufacturing Director recognized valued accomplishments across all of the manufacturing lines by allowing the team producing the accomplishment to choose music broadcast across the entire factory while everyone returned from afternoon breaks. With this data it was our turn and the team selected some rock and roll, the Manufacturing Associates returned to work, sashaying in rhythm to the beat and to the applause of other assembly line workers.

The change in the structure of the continuous quality improvement network had changed the assembly process for the hand-held scanners. We collected data every day on the failure rate of the hand-held scanner and graphed the history of laser motor wobble, highlighting the social action research phase.

Percent reject due to wobble



I mapped the study phase of the continuous quality improvement cycle following the Manufacturing Associate's wobble solution.



Missing from the network key is the orange figure from the social network map. The

Manufacturing Associates identified me as a collaborator in solving wobble.

We were accountable for improving the quality while controlling costs. We studied the cost savings of our quality improvement.

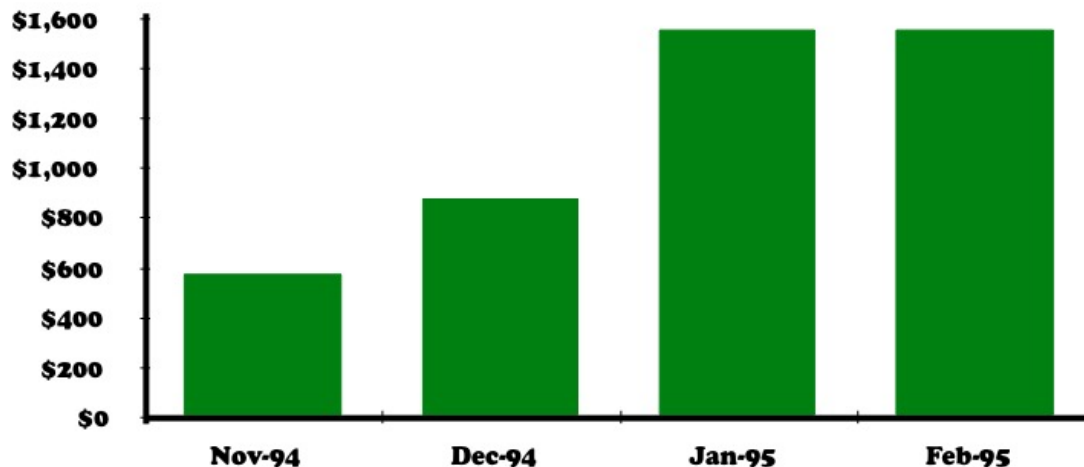
Having measured the time spent by the Manufacturing Associates studying wobble I calculated a *return on human investment* (ROHI).

Cost of studying wobble

Training costs.....	\$ 84.50
Team meetings costs.....	.\$147.88
Data collection costs.....	.\$ 29.58
Total cost of studying	\$262.00
Changes in the cost of rejection due to wobble	
November cost saving.....	\$ 577.00
December cost savings.....	\$ 874.00
January cost savings.....	\$1,556.00
February cost savings.....	\$1,556.00
Change in cost due to wobble rejection.....	(\$4,563.00)
Return on human investment.....	17.42:1

For every dollar spent on the Manufacturing Associates study of wobble the company saved \$17.42 from the process improvement. A savings that would compound each month the new assembly process was used.

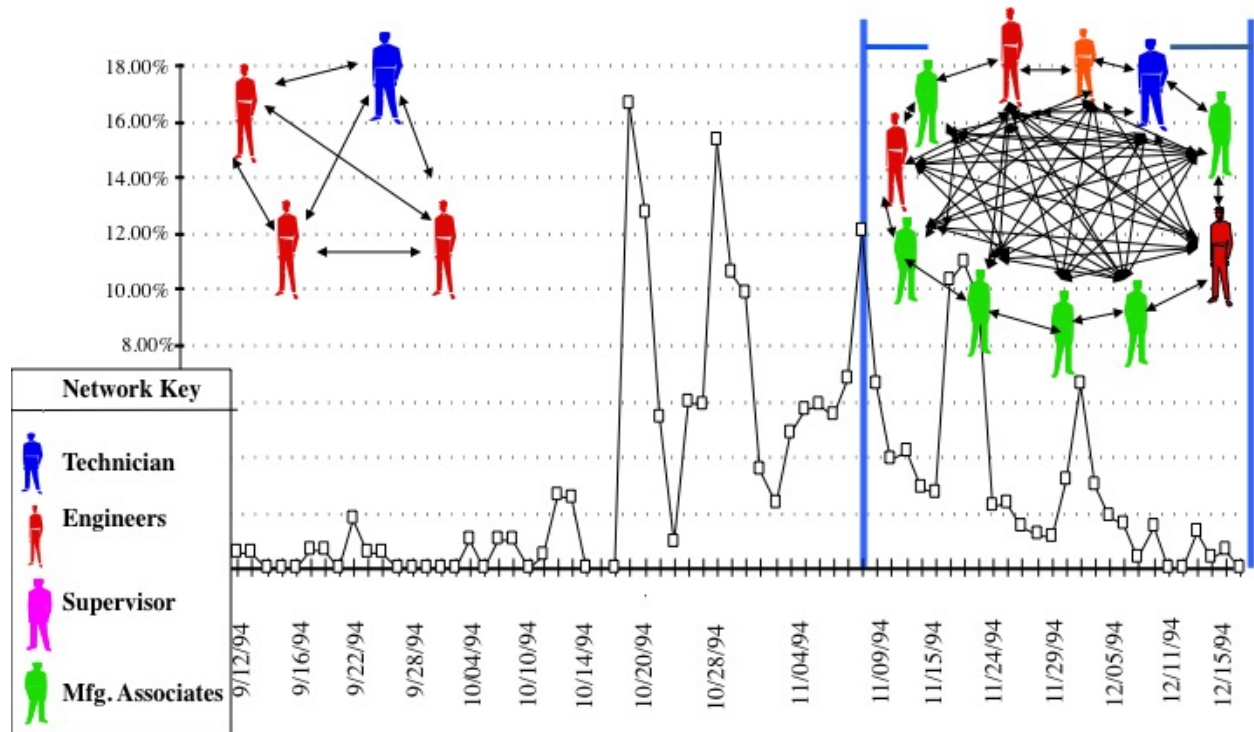
Monthly cost savings



Finally, plotting the social network maps over the failure due to wobble trend lines I learned that by changing the structure of the social network we improved product quality and saved the company money.

From whom do you get support to study "wobble"?(Oct.)

From whom do you get support to study "wobble"?(Nov-Dec)



The social and financial impact of social action research

We learned that by changing the structure of the company's quality improvement network by including the Manufacturing Associates, the company saved more money than it spent by giving the Manufacturing Associates the freedom to study their processes.

The Chief Financial Officer for Spectra-Physics was earning his MBA at the University of Oregon and asked if he could do an action research study of social action research. Absolutely! The more we study the more we learn. This is from his paper [1].

(Dennis) used a proprietary technique called workforce quality improvement as a means of improving workforce productivity.

The action research was operating on two levels the first being conducting an action research project "in action" and the second being an analysis of human investment and return on human investment.

This was a very high-quality action research project. The steps they followed are aligned sequentially with the textbook approach. More importantly is the method in which (Dennis) involved the work group in every phase of the research teaching qualitative and quantitative skills to the motor team that enabled them to conduct the research. The anticipated result is a strong reinforcement and empowerment and resultant recursive effect.

The fact that Dennis includes a monetary analysis of return on investment is to be applauded. This type of payback analysis is rare in research and yet is usually the most important factor when determining effectiveness of continuous improvement.

The actual savings seem to be substantially understated and therefore the monetary impact of the project understated.

The process employed by Dennis makes use of the critical principle of collaboration, incorporation of local knowledge, and eclecticism and diversity that enables action research to be truly successful. Their work seems to epitomize Kurt Lewin's view of "There is no action without research and no research without action."

Qualitative survey of participants

What did you like best? "it enabled members of the motor team to interact and actually work as a team to solve a problem".

What did you like the least? "lack of time to do justice to the new techniques."

The team saw this as a positive experience and were acting in good faith to improve their area, not to satisfy the needs of the researcher.

1. Eckerdt, A., *Action Research: Emphasis on Human Investment in the Private Sector*. 1995, EDPM 607, University of Oregon.