Case study

Cultural change through ergonomics – a case study of participation in a manufacturing environment

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Abstract

Background: Tasman Sinkware manufactures stainless steel sinks and tubs for the Australian and overseas markets. The workforce was having difficulty adapting to changed techniques and layouts required to stay competitive and inefficiencies were impacting on production rates and costs. It was proposed that the problem should be tackled via an ergonomic approach rather than a purely engineering or human resource standpoint, as had been trialled in the past. **Aims:** An ergonomist was engaged to act as a facilitator for ergonomic change aimed at reducing the incidence of musculoskeletal injuries via engineering options. A concurrent aim was improving acceptance of cultural change in an environment of long-term workers facing uncertainty in an altered manufacturing environment. It was hoped that the program would facilitate teamwork and ownership of the change process that would then translate into improved production rates and a more efficient work flow. **Method:** In 2010, a project team was selected with a cross section of employees from the manufacturing manager to a variety of operators. A series of meetings with specific outcomes for each meeting, including action lists that were practical and achievable, was undertaken. The program plan included training selected employees in REBA assessments and using this as a tool to identify problem areas in terms of posture-related risks. Each identified problem, including the basics, such as housekeeping matters and effects of the upstream production, was targeted in monthly meetings and an action list developed with realistic solutions. All production workers were kept informed via tool box meetings and were encouraged to participate where appropriate. The project ran for nearly 12 months with the ergonomist's assistance and is now continuing in a modified format. **Conclusions:** The results were measured in quantifiable recording of improved production rates, decreased double handling, improved work flow, and decreased musculoskeletal risk factors. The most important result was the positive effect that the formation of the team had on implementing effective solutions that were sustainable. The ergonomic approach worked very effectively and achieved a successful outcome primarily due to the facilitation process and motivation of the group to stay focussed.

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Background

Tasman Sinkware is a mid-sized manufacturer employing 70 people in its Adelaide operations, with many long term employees. It is the only Australian production line manufacturer of stainless steel sinks and tubs for the Australian and overseas markets. There are significant market forces acting upon the manufacturing environment with cheap sink imports being available and creating an extremely competitive market.

The company identified that inefficiencies in work flow were impacting on production rates and costs. Repeated attempts to introduce new production line layouts to improve efficiencies were met with resistance and failure to sustain improvements. For example, in the packing area several attempts over the past few years had been made to change the way that the work was undertaken. Different configurations of the packing production line had been put into place and significant development work had been performed by the company's managers and engineers. The attempts at improving work flow and implementing efficiencies had been met with such severe resistance from the workers that the changes reverted back to the traditional methods. This resistance stemmed from a combination of difficulties with identifying how to put the changes together as a whole, which would consider the upstream processes, personality clashes and the workplace culture not being conducive to change. This included all layers of personnel from the management team to the long-term workers with historical factors impeding the introduction of change.

A proactive in-house rehabilitation consultant, who was a long-term contractor, approached the company with a proposal to tackle the problem via an ergonomic approach rather than a purely engineering or performance management standpoint as had been trialled in the past. The company embraced the concept and an ergonomist was approached to further develop the potential for this intervention of change led by ergonomics.

Aims

The initial project proposal put forward by the ergonomist concentrated on musculoskeletal injury reduction, with the ergonomist acting as a facilitator for ergonomic change

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to reduce the incidence of musculoskeletal injuries via engineering options. Injury prevention was seen as a tangible factor easily identified by the workers due to the incidence of a significant number of injuries and people on alternate duties, which was impacting on the work flow. In this project, the packing area was targeted for specific improvements as this was the area where inefficiencies had been identified and changes had previously been met with resistance.

The concurrent aim was acceptance of change in an environment of long-term workers facing uncertainty in an altered manufacturing environment. It was hoped that the project would facilitate teamwork and ownership of the change process that would then translate into improved production rates and a more efficient work flow.

After formation of a project team, collaborative aims for the project were developed which initially were to decrease injury risk. The full list of 'aims' for the project was only clarified by the team after they became a 'team'. As time progressed, the more specific aims identified were to:

- decrease injury risk;
- improve working comfort;
- decrease double handling;
- improve the mechanics of workflow;
- improve work flow times;
- address housekeeping issues where they impacted on production; and
- improve teamwork within the packing area.

Method

The initial ergonomic project proposal was developed after a site visit involving discussion with the workers and managers in a walk through style visit. After acceptance of the proposal, the project commenced in July 2010 with the selection of a project team, including a cross section of employees from the manufacturing manager to operators. Specifically, the make up consisted of two production line workers, the team leader in packing, plant engineer, production manager, manufacturing manager, the external but long-term contracted rehabilitation consultant and the ergonomist as facilitator, with a total of eight members. Input and direction into the make-up of the team was the first action undertaken by the ergonomic facilitator and was considered the key factor in achieving change in the workplace.

All production workers were informed of the project via an initial tool box meeting and a leaflet personally handed out to them, along with notices on the board. They were encouraged to participate where appropriate. Regular updates regarding progress were also provided via tool box meetings at monthly intervals. There was an attempt to gather design solutions from the wider factory personnel, not just the packing area; however this did not proceed due to logistical issues.

A series of meetings with specific outcomes for each meeting, including action lists that were practical and achievable, were undertaken. The process of actions followed the basic risk assessment model of identification, assessment, control, review, and monitoring. Identification was undertaken by historical injury and production data such problems causing decreased quality and lower production rates along with the group's knowledge of the problems. There were several assessment methods chosen with the Rapid Entire Body Assessment (REBA) [1] the tool of choice for the musculo-skeletal risk factors. REBA was chosen for its simplicity, ability to be used as an interactive tool to promote interaction between team members, and the use of the risk rating score that enables a comparison pre- and post-intervention. Production measures, such as speed, quality and number of times the sink was handled, measured as the number of 'pick ups and put downs' of sinks, were also used for assessment and comparison data.

One of the first actions was to concentrate on the musculoskeletal risk factors present in the packing area. The full team were trained in using REBA as a tool to identify problem areas in terms of posture-related risks. After a theoretical training session, the team was divided into pairs with a manager and operator in each pair and training assessments were conducted in the packing area. Following this training, the teams' actions were to undertake formal assessments of each process in their pairs then conduct another assessment with a different partner in order to minimise inter-rater variation and increase assessment reliability.

The formal assessment process had several effects and has been attributed by the team as being the crux of all changes that were developed over the course of the project. It was utilised effectively to focus the team on changes that were required in a step wise process, rather than a reactive manner as had occurred in the past. The by products were a significant difference in the way the team communicated with each other, an improved focus on the aims of the project and a method of breaking down barriers of personality and position.

Once the high risk areas had been identified, the individual processes were evaluated as to what factors contributed to these risks. All areas were considered which included upstream factors affecting quality of the product. For example, multiple defects in the sinks created storage problems in the packing area, double handling, increased time in inspection and repair which in turn created bottle necks and uneven work flow. The method of completing the work from inspection, polishing and packing was identified as having double handling of the sinks with increased lifting and shifting contributing to injury risk and slow production line speeds. Each identified problem, including the basics, such as housekeeping matters and effects of the upstream production, was targeted in monthly meetings and the action list modified according to achievement and identification of realistic solutions. Potential solutions were assessed against a review of the REBA risk rating to determine effectiveness of the action and production impacts were evaluated.

Equipment needed to solve ergonomic problems was sourced as solutions were identified. For example, electric height adjustable tables were purchased to decrease bending required and consumable items were relocated to decrease reach distances. One of the highest risk factors occurred in a task called back taping, due to the bend, reach and twist required to undertake the application of tape. Various engineering

solutions were considered and some trialled, however an easy effective solution was not identified. As a direct result of this, there was enough evidence to convince the company to outlay a significant capital expenditure on a robotic solution to the problem.

Once the team had considered different layout and equipment options a trial re-configuration of the packing line was undertaken. The new line configuration eliminated most of the lifting and shifting of the individual sinks, especially above shoulder level as was occurring previously, with a bench-to-bench transfer between work stations being undertaken instead. Consumables were located in areas that were within reach and did not hinder the throughput of the sinks. A diversion line for repairs and defects was created to avoid double handling. Housekeeping, including supply of consumables, which had been identified as a problem with space, was addressed however this proved to be one of the hardest issues to solve and obtain agreement on. Other changes made included roller conveyor sections connecting workstations and acting as a divert where required, height adjustable tables, changed storage methods including bulk items and small consumables, relocation of redundant equipment out of the area, installation of a pallet lifter, and the previously mentioned ordering of a robotic solution to one of the identified high risk tasks. There was a follow on effect of improved communication between upstream processes resulting in fewer defects in the product and therefore a more streamlined production process.

Ongoing tweaking and modifications to layout ensured over the months with a layout being fixed into position after six months of trials and revamping. Each month the project team met to discuss the changes, the problems identified and potential solutions to these. Each individual was allocated a set of actions to complete in the time between the meetings. The monthly meetings and interim meetings served to keep the project focussed and directed with actions being reported on at regular intervals assisting to keep the pressure on to change and improve. The involvement of the ergonomist was ceased at a mutually agreed point in the life of the project, where a clear future path of action had been identified and the teams commitment would continue the momentum of change.

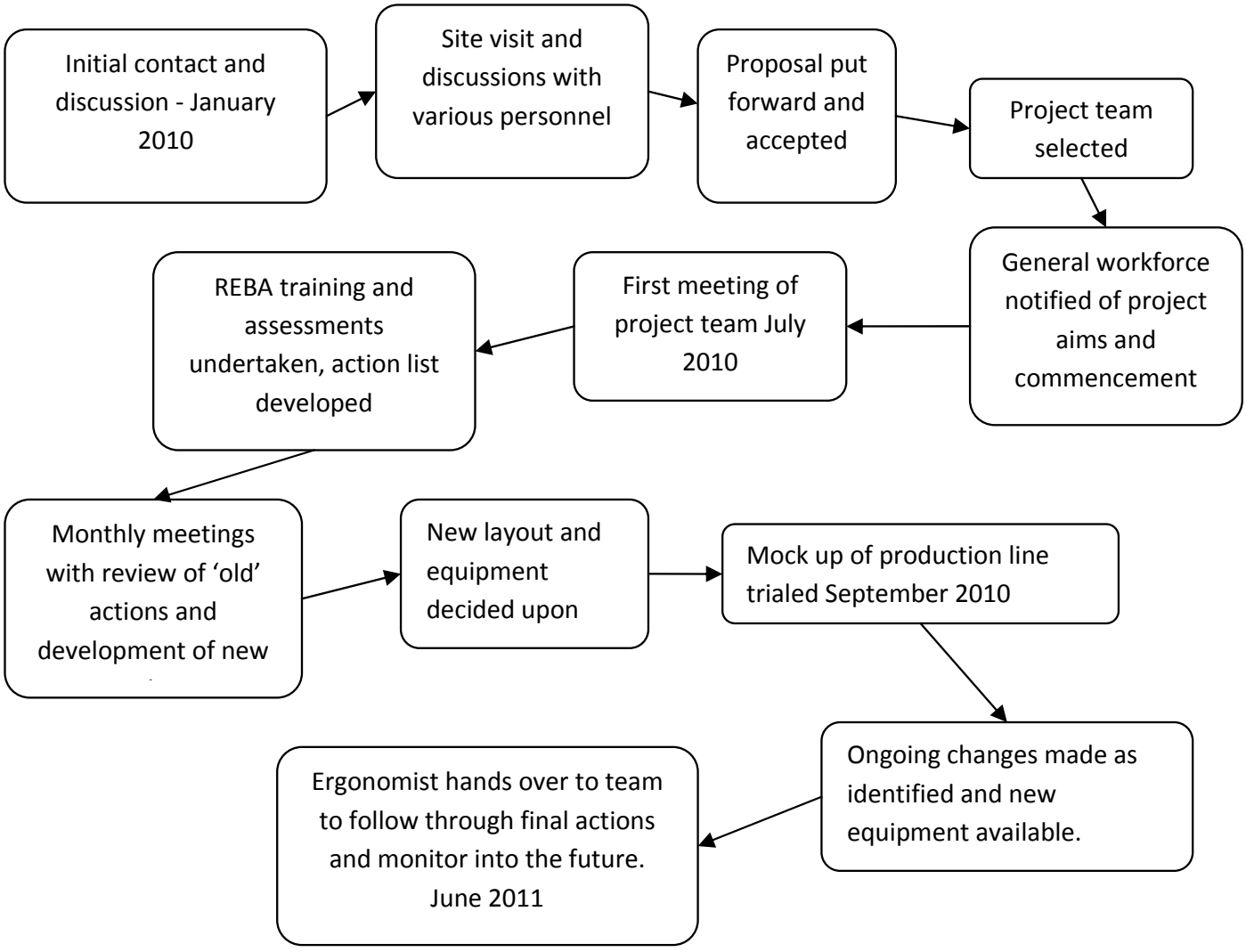

Figure 1. *Timeline of the project*

Results

The project ran for nearly 12 months with the ergonomist's assistance and is now continuing in a modified format. Overall, there were multiple changes made with some of these minor, but with a significant impact, and others that involved capital outlay and larger structural changes. At the final project meeting with all present the team reviewed the progress-to-date and acknowledged that in a manufacturing environment the end product is never reached – there is continuous improvement and external forces that require systems to be modified. Some of the outcomes that were quantifiable were:

- Decreased double handling of the sinks from 7 pick ups and put downs per sink to 1, with a resultant reduction in injury risk rating, as measured by REBA, and increased productivity.
- Improved work flow and speed of processing through inspection, cleaning and packing. Prior to implementation of the changes a sink took up to 15 minutes to process, post-implementation of changes this decreased to four minutes per sink, representing a significant improvement.
- Improved quality of product through a flow on effect of the project upstream of packing, resulted in decreased numbers of repairs required by 15%.
- The issuing of personal work equipment and 'bum bag storage' decreased loss of hand held tools.
- Purchase of specific trolleys for consumable goods decreased double handling and saved space.
- Decreased back flexion required by 70% using height adjustable work benches and pallet lifter.
- Visual scheduling process between areas improved communication on flow of work.
- Improved housekeeping.
- Added quality processes that improved the end product.

Those that were more subjective were listed as:

- Improved communication, not just in the project team itself, but in the wider factory community, leading to change opportunities in other areas of the factory.
- Opportunity for input from all employees.
- Process of change less personality driven and more outcome driven.
- Satisfaction at improved team functioning with decreased negativity in the workplace.

The desire for cultural change, articulated by the company at the start of the project as being acceptance of change by the workforce (that was also one of the main project aims), was not measured by a specific tool, therefore, the achievement of this aim was based on subjective findings. While these achievements were based on subjective reporting, there were also measureable achievements in the production process that could also be regarded as an indication of changed behaviour, given the historical difficulties in implementing this change.

Conclusions

The results of this project were measured in terms of the achievement of improved production rates, decreased double handling, improved work flow, and decreased musculoskeletal risk factors as measured on REBA re-test, however the most important result was the positive effect that the formation of the team had on implementing effective solutions that were sustainable. There was a reported cultural change consisting of a reduction of negativity and acceptance of the new techniques in the packing area which flowed through into other areas of the factory, as measured by upstream production improvements directly linked with the packing area project.

The ergonomic approach worked very effectively and achieved a successful outcome, primarily due to the facilitation process and motivation of the group to stay focussed on a step wise approach. From the companies perspective, the achievements in all areas, not just the improved productivity, was highly valued and recognition was given to the value of participation in the change process.

From an ergonomists' perspective, there were several key elements identified that contributed to the success of this project in meeting the initial aims. It is essential to have at least one enthusiastic person in the company to drive the process and keep the whole group enthusiastic. In this case it was the rehabilitation co-ordinator who had worked in the environment for many years and had knowledge of the history of the company enabling recognition of the barriers to change. Another key element was the power generated from the musculo-skeletal risk assessment tool. The use of REBA with a test / re-test facility was crucial in attaining funding for major capital expenditure and for generating the catalyst for teamwork. It was a concrete action with an easily understandable function and purpose that the wider workforce could identify with and acted as an excellent starting point for action. Finally, the change process cannot be rushed. It requires a long-term vision, long-term involvement and is an evolutionary process. The project in modified format will continue to proceed with the team moving forward on an action list still to be implemented and then reviewed. The success of a project of this type could also be measured by its ability to self generate and continue independent of an external facilitator.

Acknowledgements

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1. Hignett,S. and McAtamney,L. (2000) Rapid Entire Body Assessment (REBA), *Applied Ergonomics*, 31, 201-205.

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