

## JUSTIFYING INVESTMENTS IN ERGONOMICS - PRE-INTERVENTION

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#### **Abstract**

At past ACE and Applied Ergonomics Conferences we presented methods to identify costs and the return on investment (ROI) of ergonomics projects. We described tools to cost justify ergonomics prior to beginning a project. The gains in labour and raw-material-usage efficiencies arising from improved ergonomics were often the greatest contributors to a positive ROI. This paper describes the methodology developed, and details the metrics that were used to determine the costs, benefits, and ROI of ergonomics projects. Where and how to collect these cost data is also discussed.

**Keywords:** ergonomics; return on investment; costs; management

## JUSTIFIER LES INVESTISSEMENTS EN ERGONOMIE – PRÉ-INTERVENTION

#### **Résumé**

Aux conférences de l'Association canadienne d'ergonomie des années précédentes, nous avons présenté une méthode permettant d'identifier les coûts et d'évaluer le taux de rendement pour des projets d'ergonomie. Nous avons discuté des outils permettant de justifier financièrement un projet d'ergonomie avant l'implantation. Jusqu'à présent, les bénéfices reliés à la main-d'œuvre et aux matériaux utilisés étaient les plus significatifs, tout en offrant un excellent taux de rendement. Cet article décrit la méthode et les outils utilisés pour estimer et mesurer les coûts, les bénéfices et le taux de rendement des projets d'ergonomie.

**Mots clés :** investir en ergonomie, taux de rendement, gestion

## 1. INTRODUCTION

Our experience determining the return on investment (ROI) from a wide range of ergonomics interventions has been very encouraging, generally exceeding the expectations of the companies with whom we have worked. It was not unusual for a project ROI to exceed 100%. This paper describes a process for the justification of an ergonomics project pre-intervention. It allows ergonomists to identify unnecessary production or service costs arising from poor ergonomic designs and determines the ROI of making an ergonomics investment. It captures costs that are often described only in health and safety terms, but are not recognised for what they really are - workplace productivity inefficiencies.

Health and safety is the common reason for initiating an ergonomics project. Often jobs with health and safety issues also have productivity issues. Identifying how production processes are sub-optimized is critical to fully identifying a project's ROI. We have created a methodology by which to evaluate both the output (number of customers served or widgets produced in a given time) of the current process and its costs, and the theoretical best process. Evaluating the contribution of poor ergonomics to the difference between the actual and theoretical output becomes the key to project justification.

## 2. COST CALCULATIONS

The approach used to arrive at the calculation of costs and benefits of a specific intervention are based on a technique called A delta T (AdT). AdT represents the difference (delta) between the actual (A) costs to produce a product or service and the theoretical (T) minimum cost of the same production process.

$$\text{delta} = T - A$$

In other words, delta is the loss that occurs as a result of a sub-optimized work unit or production system. It represents the overall losses, and provides the basis for the application of ergonomics to the production process in order to reduce to a minimum production costs.

To illustrate with a simple example, let us assume that we own a coffee shop that could serve a cup of coffee every 10 seconds (T). However, we are disappointed to find out that the actual time is 12 seconds (A). (For simplicity we will assume that we always have a customer waiting to be served.) This extra 2 seconds arises from inefficiencies in serving, and unplanned costs for coffee, cream and sugar. We set out to determine what contributes to this delta loss of 2 seconds. (As ergonomists, we also identified this as a job with high levels of reaching and carrying.)

The most frequently identified delta losses (costs) can be broadly divided into two groups;

(I) Human resources

1. Labour turnover: Number of employees (quitting; bidding-out) times acquisition, separation and training cost per employee.
2. Absenteeism: Total days of employee absence times fully-loaded hourly wage; replacement hourly wage; absence control administration cost; medical care cost (if an injury).
3. Overtime: Total hours of overtime times fully-loaded overtime hourly wage.

4. Sub-optimal or additional labour: The differential (d) between planned and actual output production times the total direct and indirect labour costs.

(II) Production

1. Waste: Actual (or average) unit defect rate times cost of raw material plus other associated production and overhead costs.
2. Rework: Actual (or average) cost to recover (remanufacture) units times additional raw material, production and overhead costs times hourly wage costs to rework.
3. Downtime: Revenue per unit times number of units not manufactured.

To put these costs in perspective we also have to determine the costs for both fully-loaded direct and indirect (administration; quality; management) labor. Often direct costs are available on an hourly basis, while indirect costs are annualized. Production costs include the costs of raw materials, and production overheads such as machine time, equipment depreciation, maintenance, fuel and electricity.

For our coffee shop, we determined the key delta losses to be:

Planned Production: 1800 units / hr

Actual Production: 1500 units / hr = to a delta of 20%

**(4) Sub-optimal labor**

Total labor cost \$630,000 / year X delta 20% = \$126,000

**(5) Waste**

Production cost \$8,646,000 / year X waste 2% = \$173,000

**(7) Downtime**

Revenue: \$25,228,000 / year X d / t rate 2% = \$505,000

Total = \$804,000

The addition of the other four cost categories added less than \$60,000 to the total losses.

### 3. ERGONOMICS APPLICATION

In our example, we determined that the delta losses arose from an inferior ergonomic design of the coffee serving area. The coffee pots were beyond each server's reach zone and were located behind the client service point. Raw materials to make coffee were stored in a separate area several meters away from the service point. Cash register operations were overly complicated and difficult to learn resulting in several missteps and hence the servers were frequently under-charging the customer.

### 4. FINANCIAL BENEFITS

Financial benefits that accrue are the avoidance of the delta losses. We wanted to ensure that our solutions would reduce the delta losses and move the process closer to its theoretical costs. All costs cannot be saved with every workplace or workstation intervention. Benefits are measured and valued, based on evaluating the various cost issues and how

each solution will impact both the redesigned workplace and the production or service process. In most instances, it will not be practical to implement the theoretical best solution. However, knowing what this is enables a planning process to be initiated to justify a series of incremental workplace changes over time toward achieving that end.

In our coffee shop, we determined that we had the potential to reduce the costs of sub-optimal labor, waste and downtime by making ergonomics modifications. Three scenarios describing the potential impact on the delta losses; a worst-, most-likely-, and best- case scenario were drafted. These ranged from a worst-case saving averaging 5%, to a best-case of 25%. Our most-likely case savings were 15% in each variable. This translates into a total potential saving of \$135,000 annually.

Investment costs required to design and purchase new or modified equipment to realise these workplace and process changes, to provide personnel training, to re-allocate overhead (fixed) costs and internal resources, and to provide for any external engineering, fabrication or consulting fees would also have to be determined.

## **5. DISCUSSION**

Rigorous determination of operating and overhead costs, detailed evaluation of all benefits, and establishing realistic investment costs cannot be over-emphasized. The key to the successful justification of an ergonomics project, and the approval of management, rests with incorporating all the costs and benefits that impact a specific project. Our experience is that optimizing labour, and reducing or eliminating raw material waste from spoiled or defective product generally accounts for greater than 80% of all delta losses.

Costs can be difficult to establish on a departmental or individual-process basis. If an organisation has adopted Activity-Based Costing (ABC) as a cost accounting procedure, then they are more easily assigned to specific processes. Without ABC, our experience is that cost estimates provided by operational management personnel can be a reasonably reliable alternative.

Most organisations prefer to evaluate a significant monetary investment on an annualized basis. Therefore even if full-year costs and benefits cannot be established, they should be extrapolated to annualized figures. Where it is impractical to establish a cost or benefit directly, use of proportions based on weekly wages, monthly output, or some similar measure should be made.

All costs and benefits should be presented in today's dollars or in net present value terms. ROI's are normally expressed in terms of the organisation's discount or hurdle rate for investments, a percentage that usually exceeds the cost of borrowing. The organisation's accountants can provide this discount rate and complete these calculations. While this economic evaluation process appears onerous, it gets easier with each use, but failure to complete it may mean that all the time spent on planning your ergonomics intervention will have been wasted. Well-documented financial data will increase the chance of a successful project approval.

## **6. CONCLUSION**

Despite the best ergonomics solutions, failure to convince management of the efficacy of the project will mean that it will not be approved. Ergonomics is often viewed only as a means to prevent workplace injury. Management has no means to determine the positive financial

benefits of ergonomics and it therefore becomes just another overhead expense item in the accounting ledger. This leads to ergonomics not getting done, being only partially fulfilled or done by chance. Selling ergonomics as a “money maker” that enhances profitability and provides a positive investment requires that ergonomists build bridges with financial personnel and recognise management’s profitability goals.

This cost justification methodology has been designed to fulfill these requirements by detailing the essential steps and accounting procedures to provide an accurate economic analysis using terminology familiar to management. While workplace health and safety investments are critical, it is an additional benefit to your ergonomics efforts when you can also justify your projects on the basis of their positive ROI.

## 7. REFERENCES

- (1) BURROWS, E. , JENKINS, S. , THOMAS, G. , and RICKARDS, J. (1998). A pre-intervention benefit / cost methodology - refining the cost audit process. Proceedings: Assoc. of Can. Ergonomists 30th. Annual Conf., Mississauga, Ontario. 6pp.
- (2) JENKINS, S. and RICKARDS, J. (1997). Can I benefit from the cost of ergonomics ? – exploring a pre-intervention methodology. Proceedings: Assoc. of Can. Ergonomists 29th. Annual Conf., Winnipeg, Manitoba. 9pp.
- (3) JENKINS, S. and RICKARDS, J. (1999). “Applying Business Economics to Workplace Ergonomics - A Pre-intervention Approach”. Proceedings of the 2<sup>nd</sup>. Applied Ergonomics Conference, Houston, Texas, USA.
- (4) JENKINS, S. AND RICKARDS, J. (1999). The Economics of Ergonomics - some workplace design case studies. Proceedings: Assoc. of Can. Ergonomists 31st. Annual Conf., Hull, Quebec. 6pp.
- (5) JENKINS, S. and RICKARDS, J. (2000). “The Economics of Ergonomics - Three Workplace Design Case Studies”. Proceedings of the 3<sup>rd</sup>. Applied Ergonomics Conference, Los Angeles, Calif. USA.
- (6) JENKINS, S. and RICKARDS, J. (2001). “Cost Justifying Ergonomics”. Proceedings of the 4<sup>th</sup>. Applied Ergonomics Conference, Orlando, Florida. USA.