



ROI of Ergonomic Improvements: *Demonstrating Value to the Business*

human^{tech}®



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Agenda Topics

- Introduction
- Cost Justification Methods
 - Regulatory Compliance
 - Health and Safety Performance
 - Production Enhancement
- Creating Business Value
- Calculating ROI
- Summary and Question Period

Why Are We Here?

- Tough times
- Save money
- Weather the storm
- Measurable gains
- Demonstrate value
- Stay on course
- Reduce costs
- Cash is king



Designing for Human Performance Ergonomics

- If we design workstations within the limits of human performance, we will...
 - Eliminate work-related musculoskeletal disorders
 - Maximize productivity
 - Enhance process stability and product quality

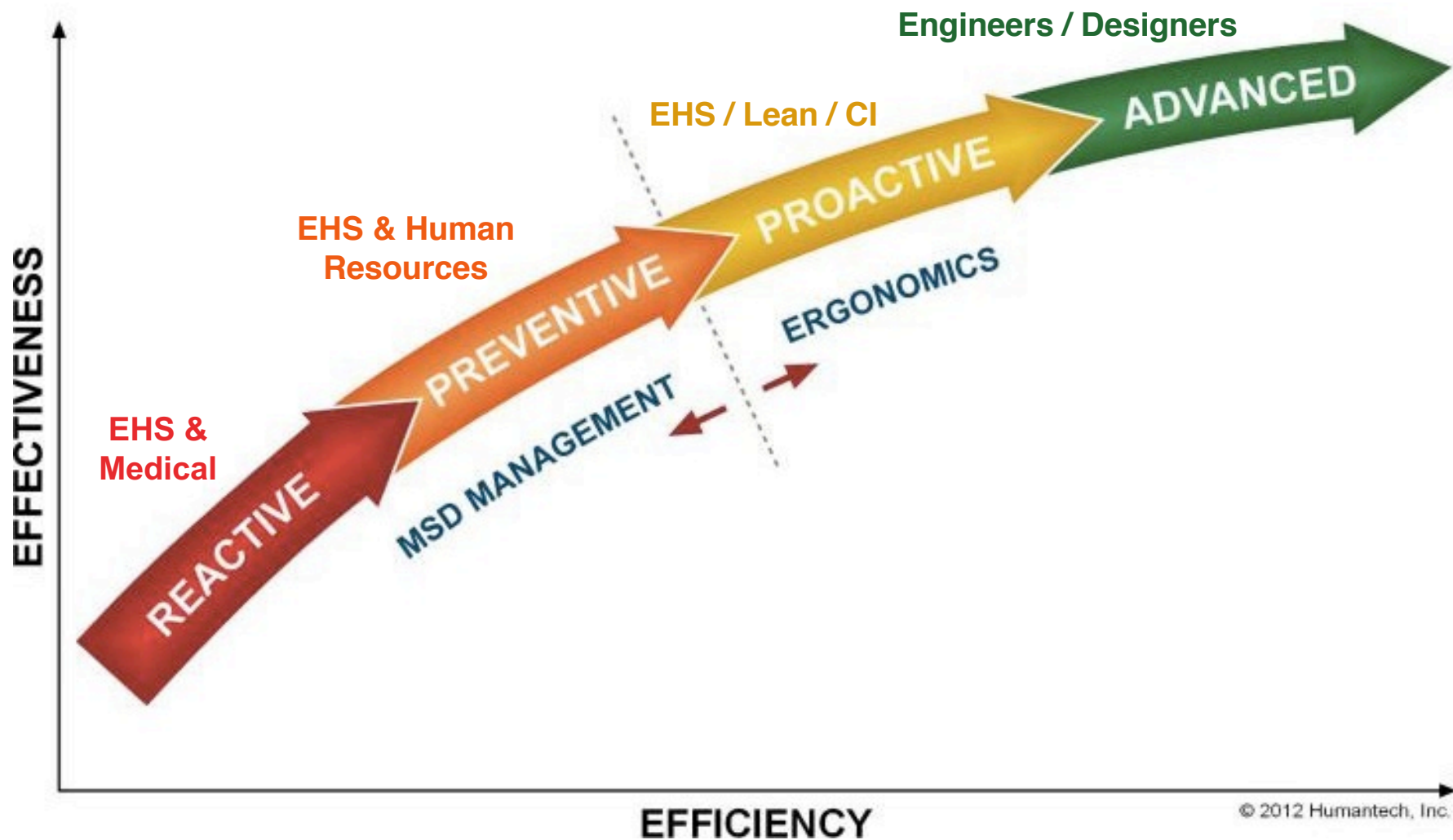
hassle - pain - WMSD



Why Does Everyone Need to be Involved?

- Ergonomics is an Engineering issue, not a Health & Safety Issue.
 - The majority of ergonomic issues are typically rooted in process and workstation design.
 - Ergonomic issues only become Health & Safety concerns once an injury has occurred.
 - Long-term fixes for ergonomic issues are typically related to engineering controls.

The Ergonomics Maturity Curve™



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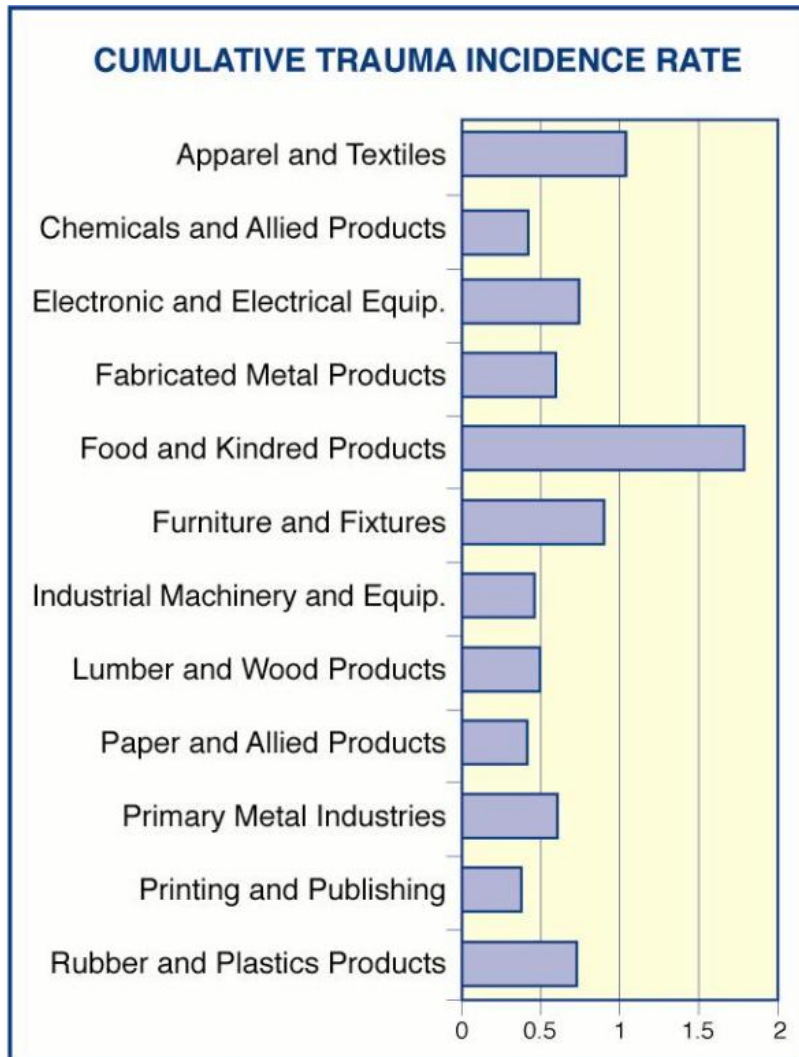
Regulatory Compliance

- Regulatory Compliance
- Health & Safety Performance
- Production Enhancement

- U.S. Standards
 - Federal OSHA
 - General Duty Clause
 - "every employer must provide a safe working environment for their employees"*
- OSHA approved state plans
 - California State Ergonomics Rule
- Outside U.S. Standards
 - European Union Directives
 - Non-European Union country standards

Regulatory Compliance

- Regulatory Compliance
- Health & Safety Performance
- Production Enhancement



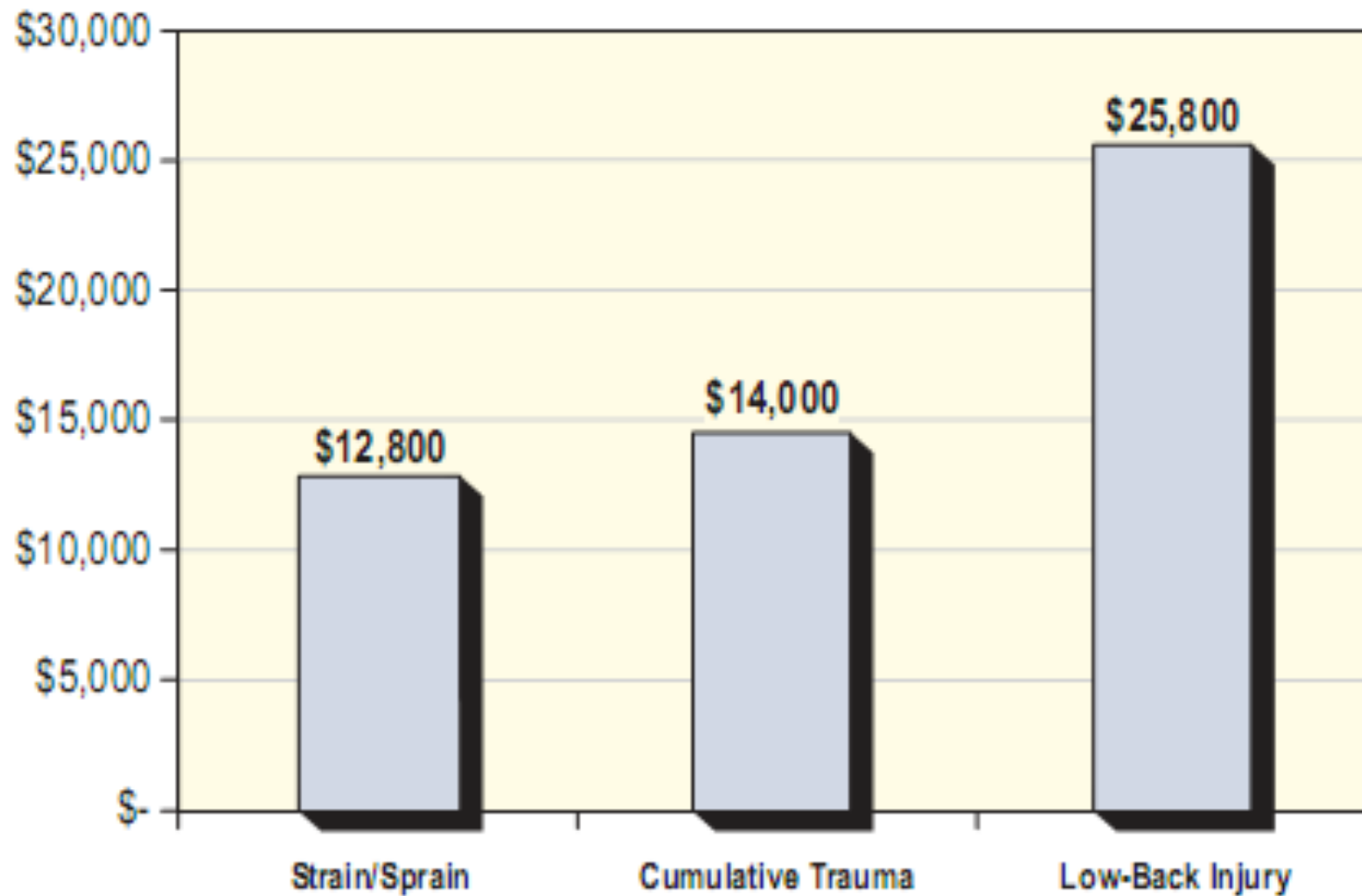
(Source: BLS, 2001)

- Why it's not effective:
 - If your site's incidence rates are below industry standards, management may believe that they are in a "no or low" risk situation for non-compliance.
- Let's consider another approach...

Health and Safety Performance

- Regulatory Compliance
- **Health & Safety Performance**
- Production Enhancement

Average Costs of WMSD Incidents



Incident Cost Iceberg

- Regulatory Compliance
- **Health & Safety Performance**
- Production Enhancement



Health & Safety

- Regulatory Compliance
- **Health & Safety Performance**
- Production Enhancement



There were ergonomic issues when reaching to a torque wrench in this assembly operation.

- Why it's not effective:
 - If there are no previous injuries, management may not see the urgency to improve the job
- Let's consider yet another approach...

Production Enhancements

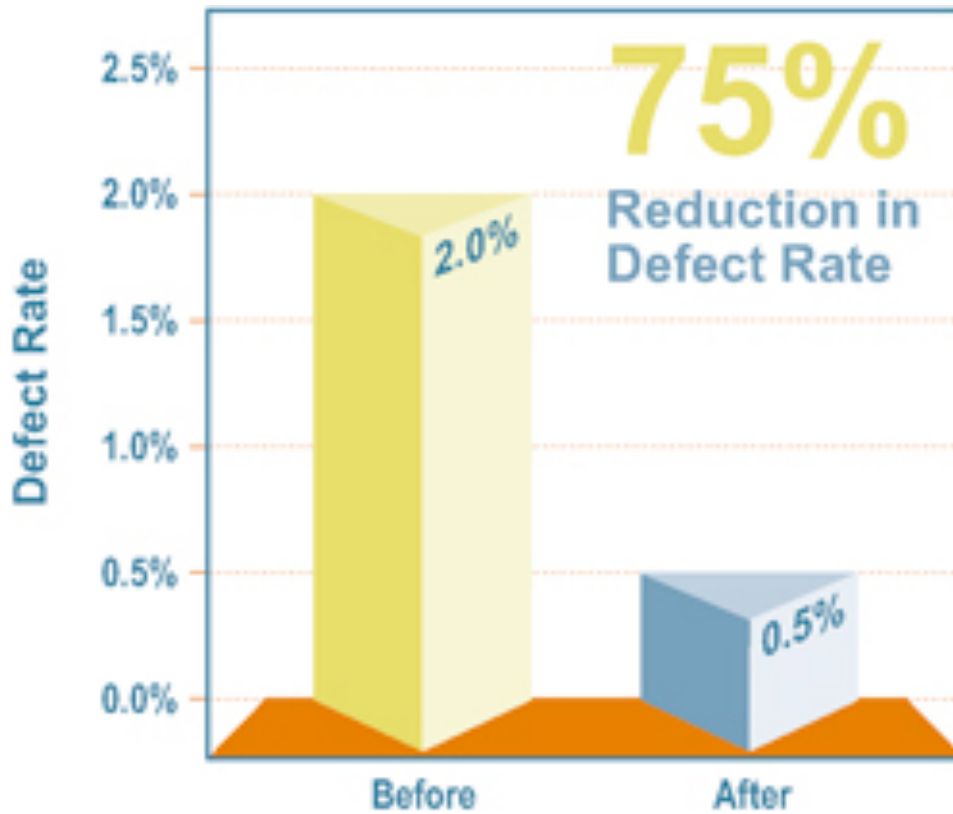
- Regulatory Compliance
- Health & Safety Performance
- **Production Enhancement**

- Ergonomic improvements are more likely to be supported and accelerated if they can fit into a cost justification process.
- Leads to cost savings in many areas including:
 - Quality
 - Delivery
 - Production (measured at the workstation level)
 - Elimination of non-value-added tasks
 - Reduction in motion waste

Quality Improvements

- Regulatory Compliance
- Health & Safety Performance
- **Production Enhancement**

DOW CORNING



- Cell re-design project for drill process
- Chipped blank = \$30,000 revenue loss
- Installed an articulating arm to transfer lens blanks



Delivery Improvements

- Regulatory Compliance
- Health & Safety Performance
- **Production Enhancement**

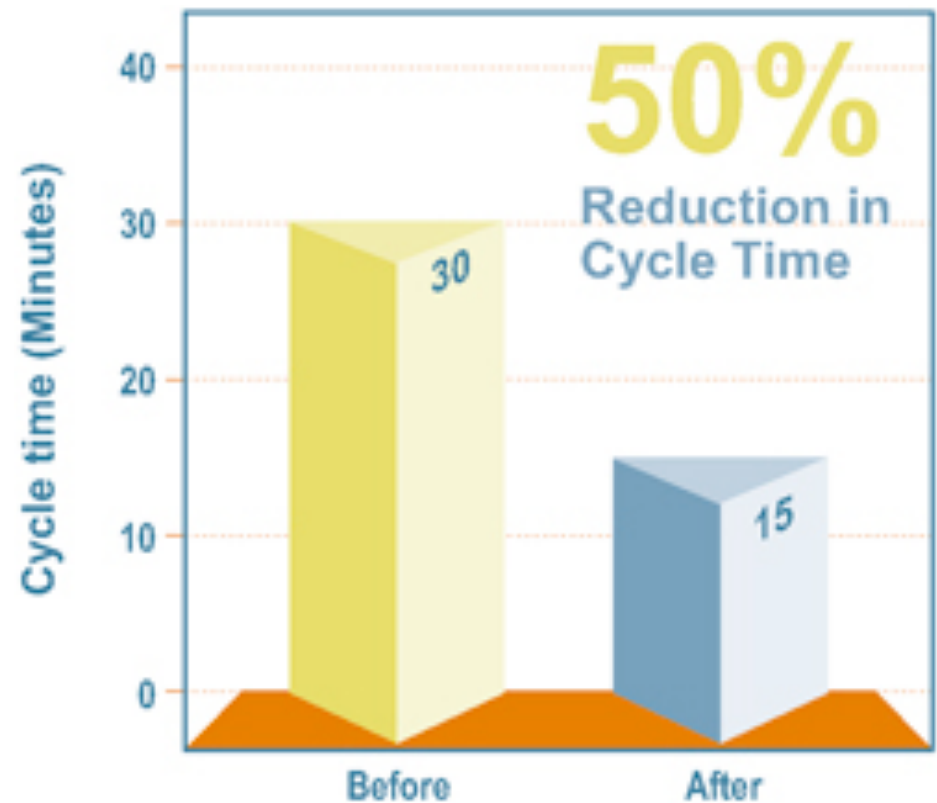
HONDA

Fender Finishing Operation

- 30 minute cycle time
 - Awkward postures (> 28" reach)
 - Multiple handling (24 lifts/cycle)
 - High scrap rate
- Built freestanding fixture and redesigned workstation
 - Reduced reaches (< 15")
 - Reduced handling (2 lifts/cycle)
 - Reduced scrap by 83%
 - Reduced cycle time by 50%

2002 ErgoCup Winner

Applied Ergonomics Conference
Baltimore, MD



Agenda Topics

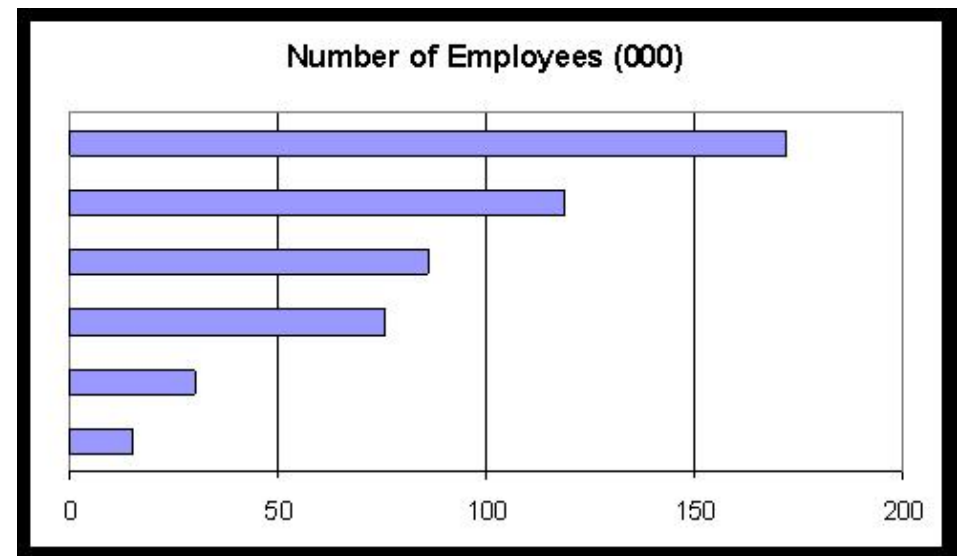
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Creating Business Value

- How are companies achieving ergonomics excellence?
 - Key activities
 - Communications
 - Tools and training

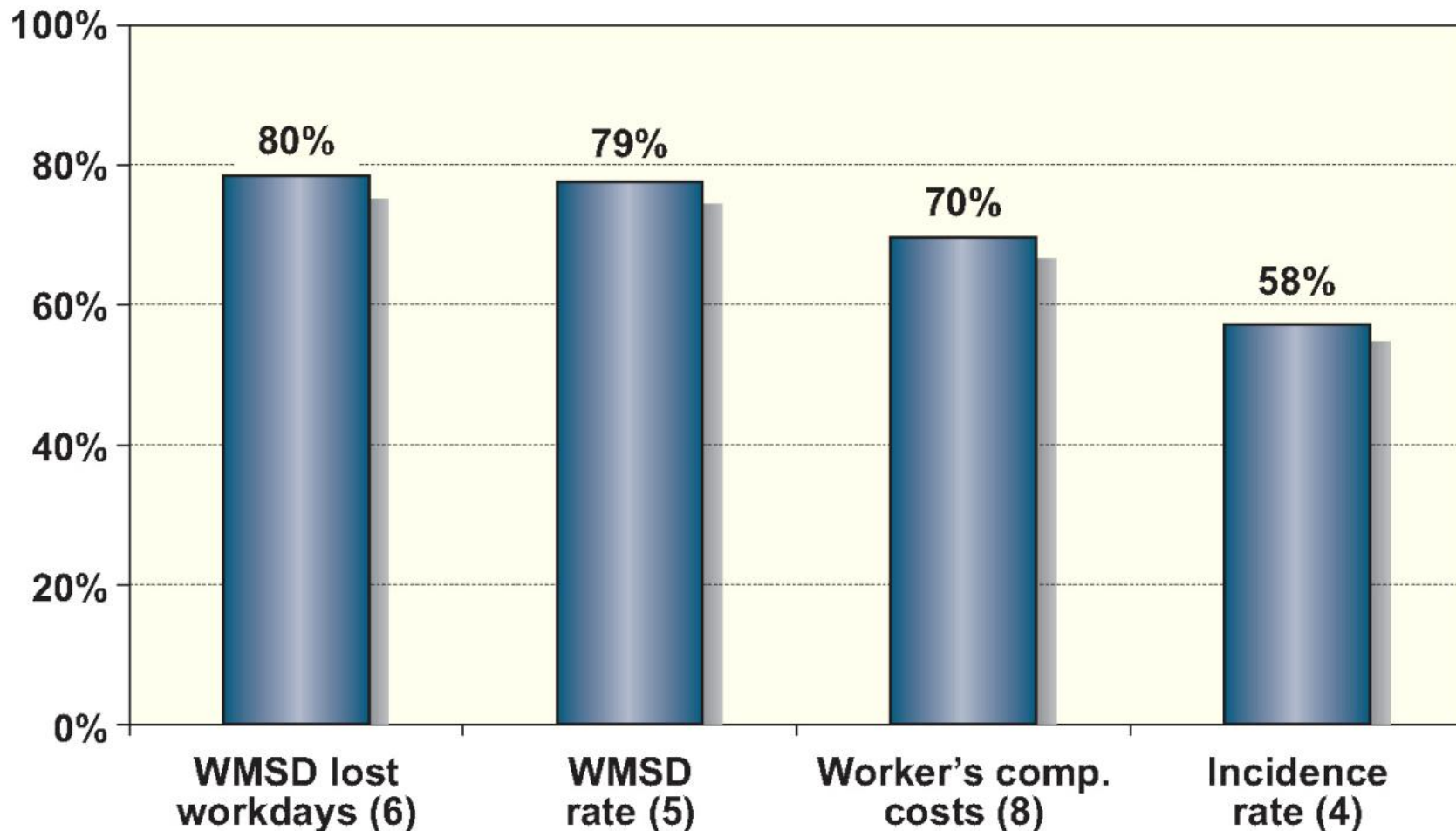
2007, 2009, and 2011 Benchmarking Studies

- Involved large companies in:
 - Aerospace
 - Automotive
 - Health care products
 - Diversified products
 - Computer systems
 - Semiconductors
 - Construction equipment
 - Industrial products
 - Pharmaceutical
 - Aluminum products
 - Steel products
- Looked at:
 - Methods
 - Roles
 - Training
 - Metrics



Ergonomics Excellence - What to Expect

Enterprise-wide results (average reductions)



Benchmarking Study: Success Metrics

Leading Indicators

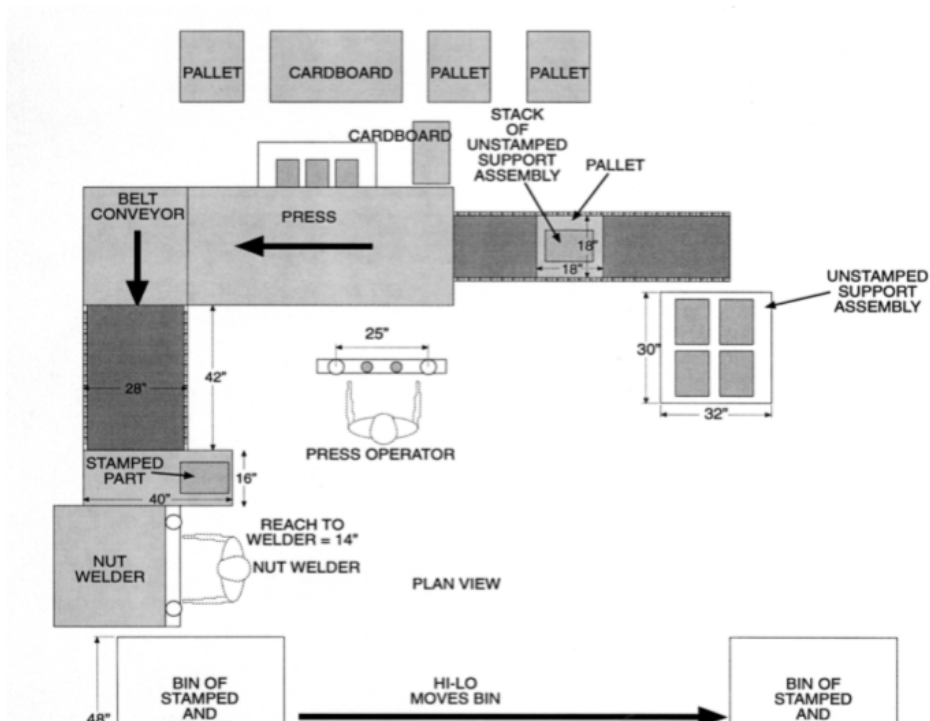
Measures that describe the **prevention** of future incidents include:

- Percent of job conditions with medium or high ergonomic risk
- Number of countermeasures implemented
- Ergonomic risk reduction
- Conformance of new equipment with ergonomic design criteria

Process Characteristics

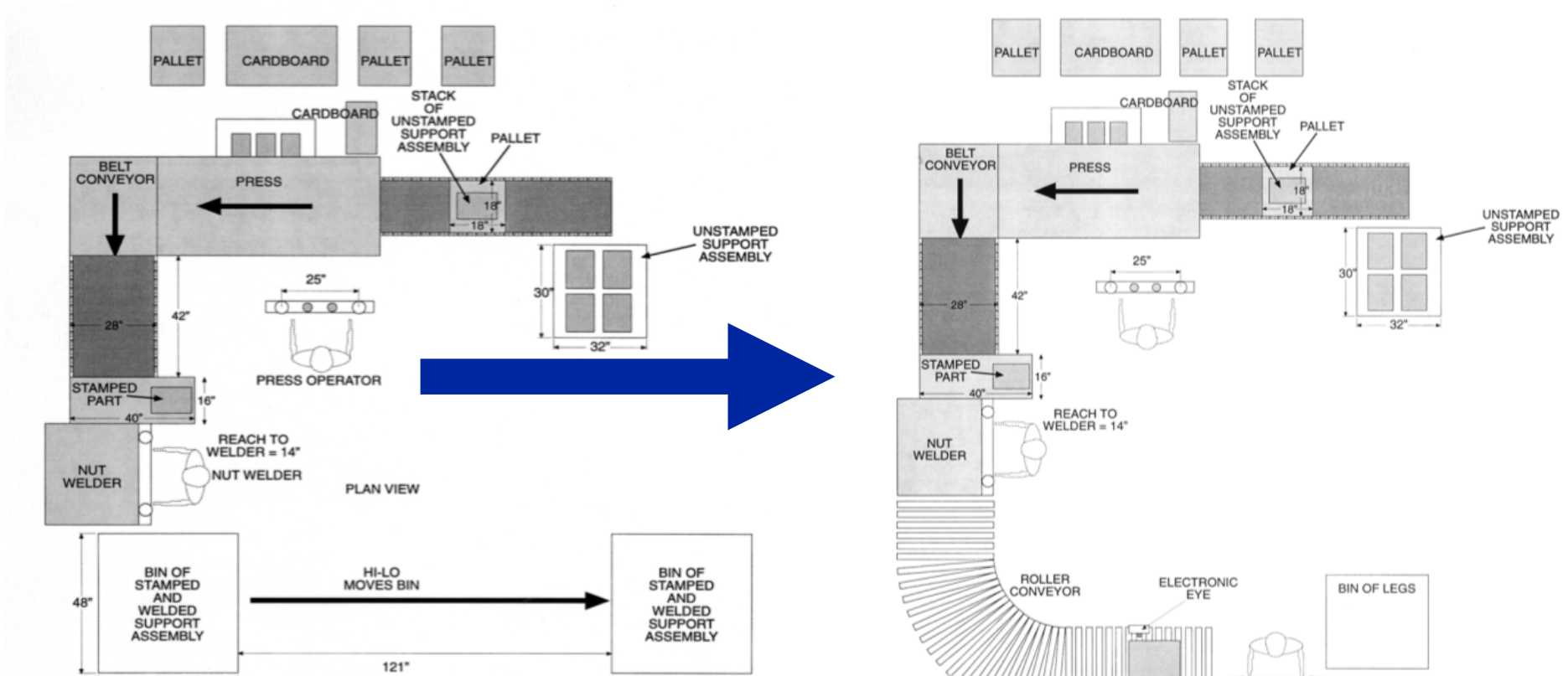
- “C” level support and sponsorship
- Management system in place
 - Policy & Guidance Document
 - Clear roles and responsibilities
 - Accountability for metrics at all levels in organisation
- Data driven with the focus on risk management
- Heavy on engineering and workplace improvement
- Engage the workforce in the process
- Integrated with other company initiatives
- VISIBLE demonstration of value to the business

Ergonomics Risk Management – Visible Change



	Left			Right			Neck	Back	Legs
	Hand/Wrist	Elbow	Shoulder	Hand/Wrist	Elbow	Shoulder			
Press Operator	Medium	High	High	Medium	High	High	Medium	High	Low
Nut Welder	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Low
Leg Welder	Medium	High	High	Medium	High	High	Medium	High	Low
Un-Loader	Medium	High	High	Medium	High	High	Medium	High	Low
Box Builder	Medium	High	High	Medium	High	High	Medium	Medium	Low

Ergonomics Risk Management – Visible Change



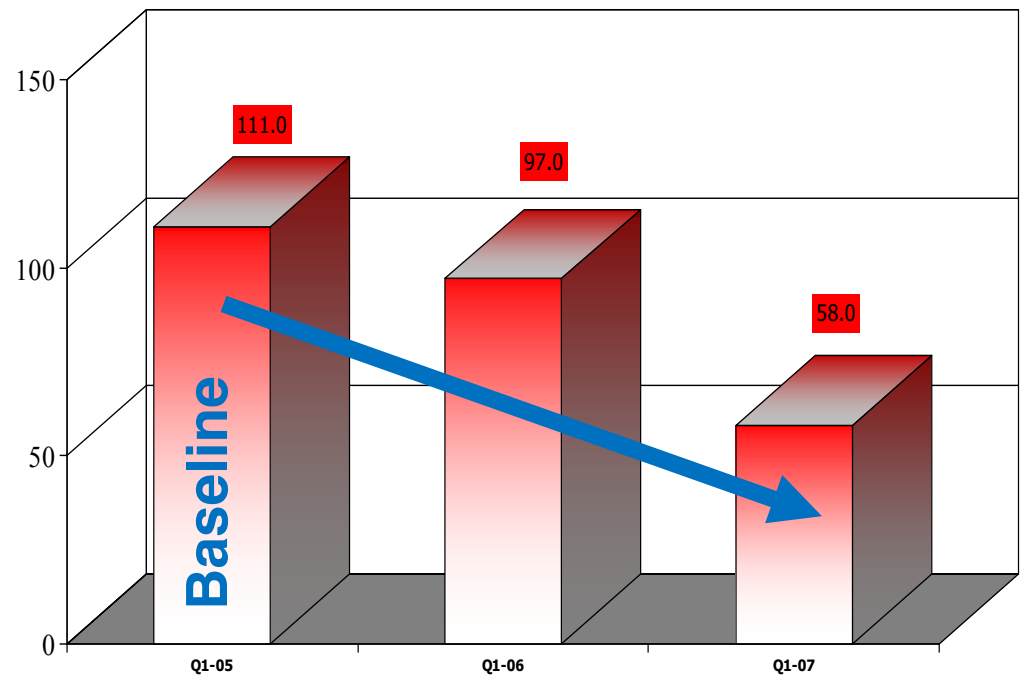
	Left			Right			Neck	Back	Legs
	Hand/Wrist	Elbow	Shoulder	Hand/Wrist	Elbow	Shoulder			
Press Operator	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Low
Nut Welder	Medium	Medium	Medium	Medium	Low	Low	Medium	Medium	Low
Leg Welder	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Low
Un-Loader	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Low
Box Builder	None	None	None	None	None	None	None	None	None

Lean/Continuous Improvement – Data Driven

Improvements	Metric	Before	Improvement Objective	Actual	Improvement
Total operator cycle time	Seconds	460	30%	315	31.5%
Productivity	Units/day /operator	31	15%	39	20.5%
WIP inventory	Units	6	10%	5	16.6%
Occupied area	ft ²	1536	20%	1325	13.7%
Quality	Scrapped units/day	3	30%	2	33.3%
Ergonomic risk	Stations BEST>29	4	100%	1	75%

Creating Business Value - Example

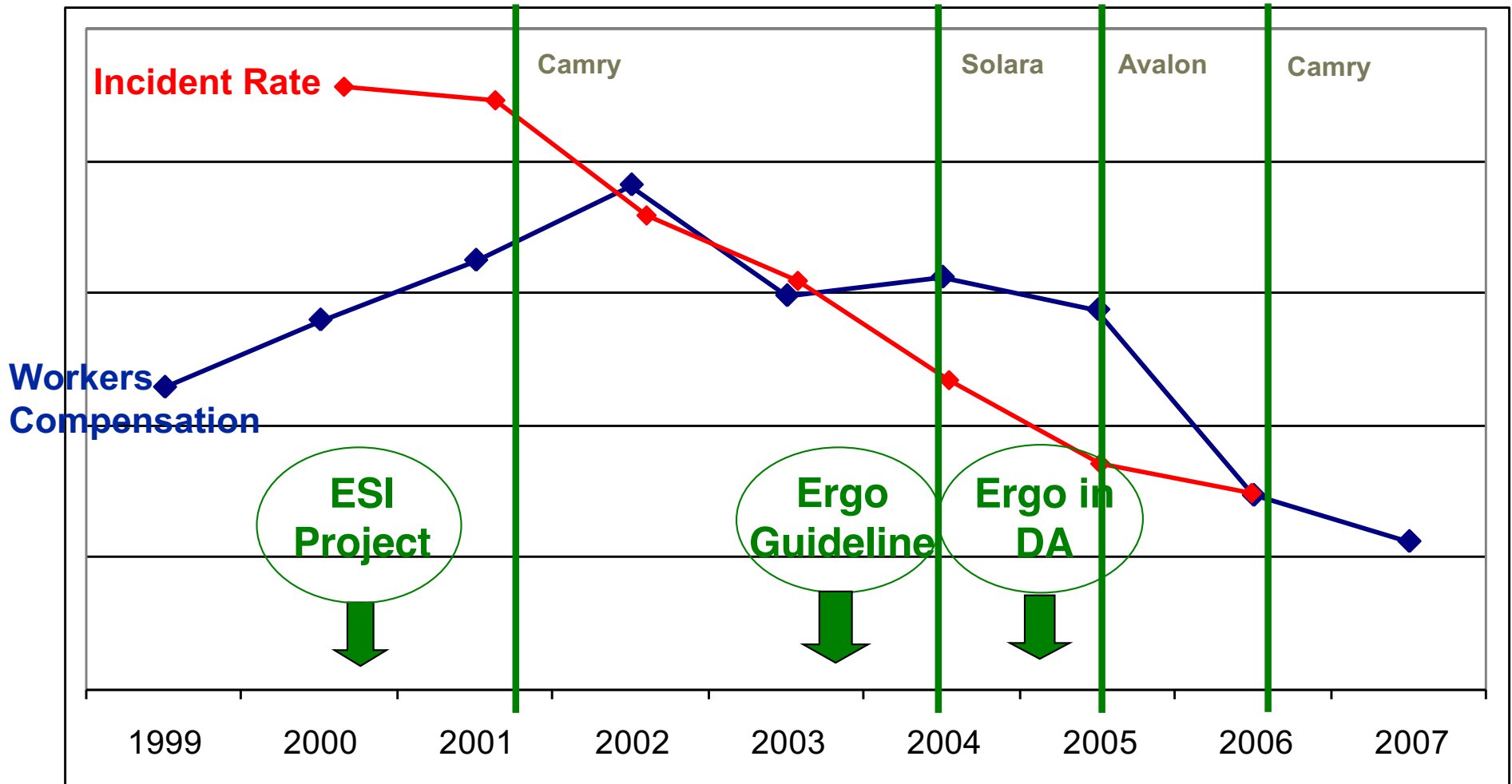
- 23 sites have implemented process
- All facilities trained in ergonomics process and tools
- Over 3,600 workplace improvements in place
- 2 year Total Incident Rate (TIR) reduction:
 - 67% EU
 - 48% NA tire
 - 55% Globally



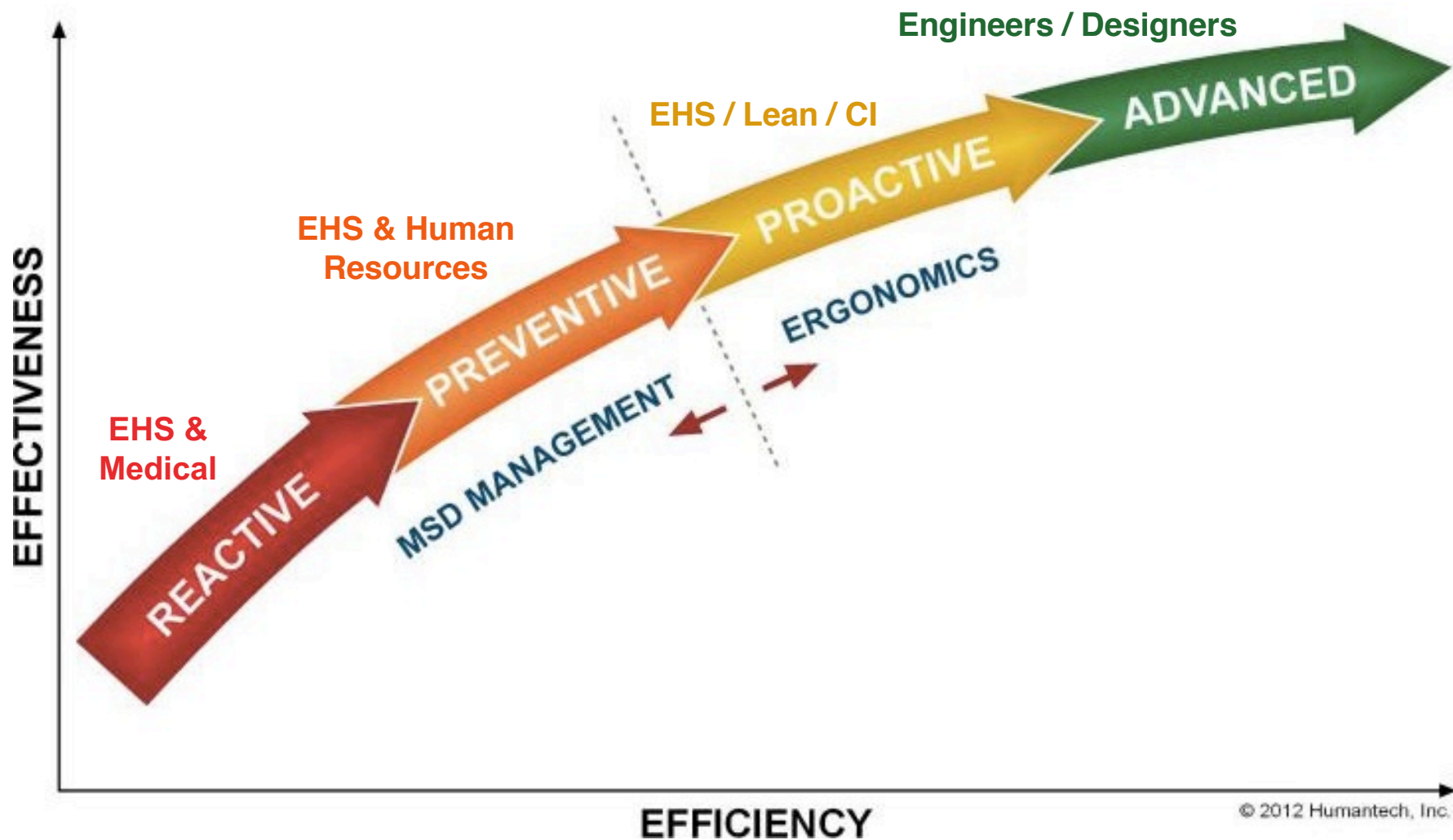
Creating Business Value - Example

TOYOTA

- IR & WC Costs Decrease as Ergonomics Is “Designed In”

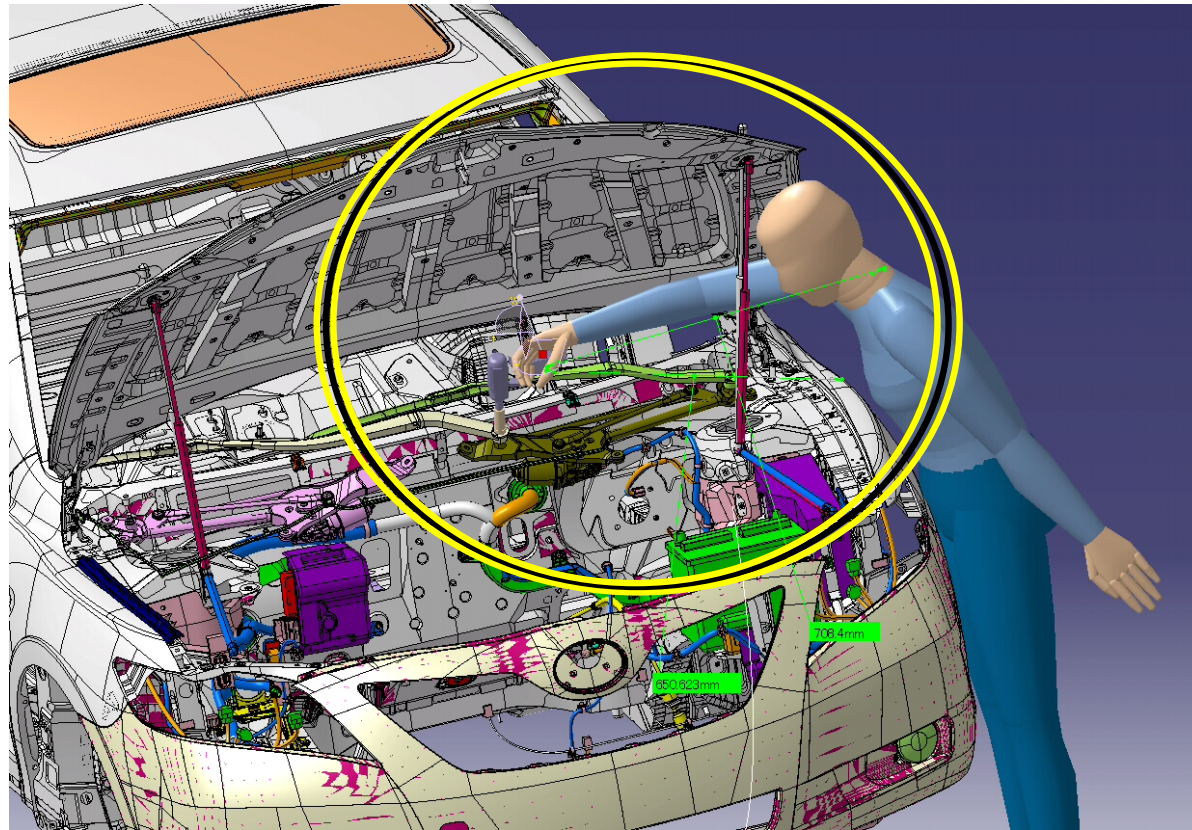


The Ergonomics Maturity Curve™



Product Design

- Using Digital Assembly
 - Clearance, Reach, Fit, Posture can be checked for each part and process

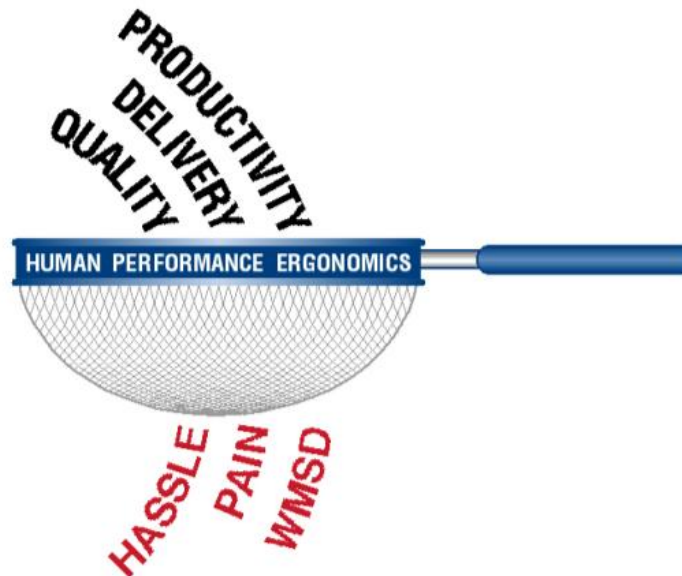


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Business Reality 101

- In today's business climate any initiative that does not deliver measurable value is an option.
- Ergonomic improvements are more likely to be supported and accelerated if they can fit into a cost justification process.
- Time can be converted to money



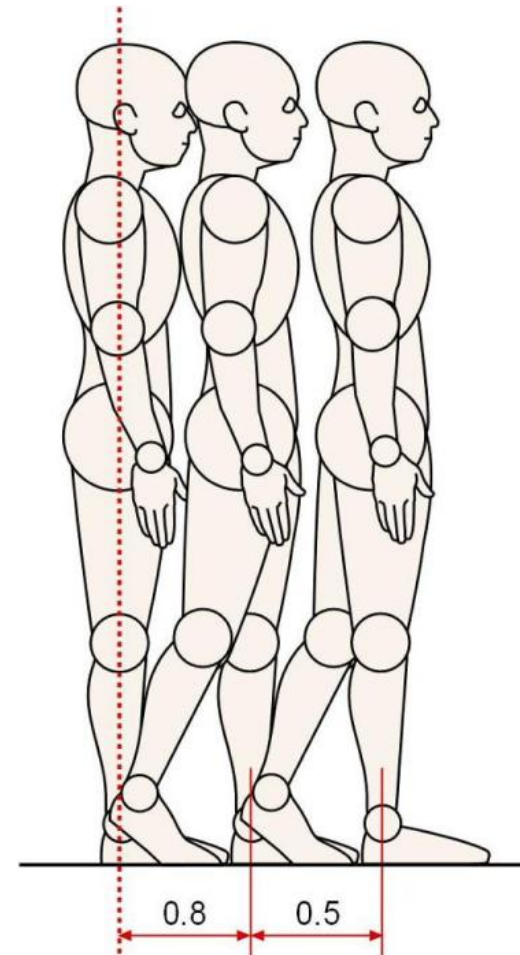
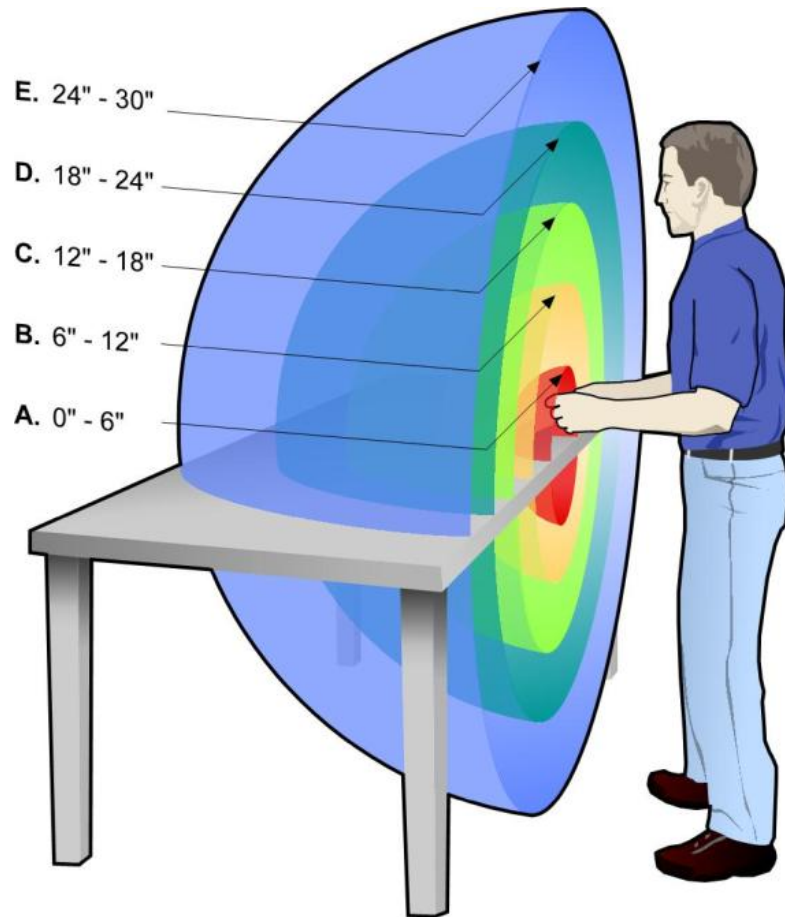
Ergonomic Projects that Result in ROI

- Are ***effective*** in reducing hazard exposures
 - Eliminate risk
 - Engineering controls
 - Administrative controls
 - Work practices
- Are ***efficient*** in reducing hazard exposures
 - Start with low cost/high impact

Cost Justification

- In the manufacturing environment **time** is the dominant currency.
- And we know that awkward postures, high forces and repetitive movements take more time to complete.
- The challenge is quantifying financial benefit of reducing force, frequency and posture.

Motion Waste – Reaching and Walking

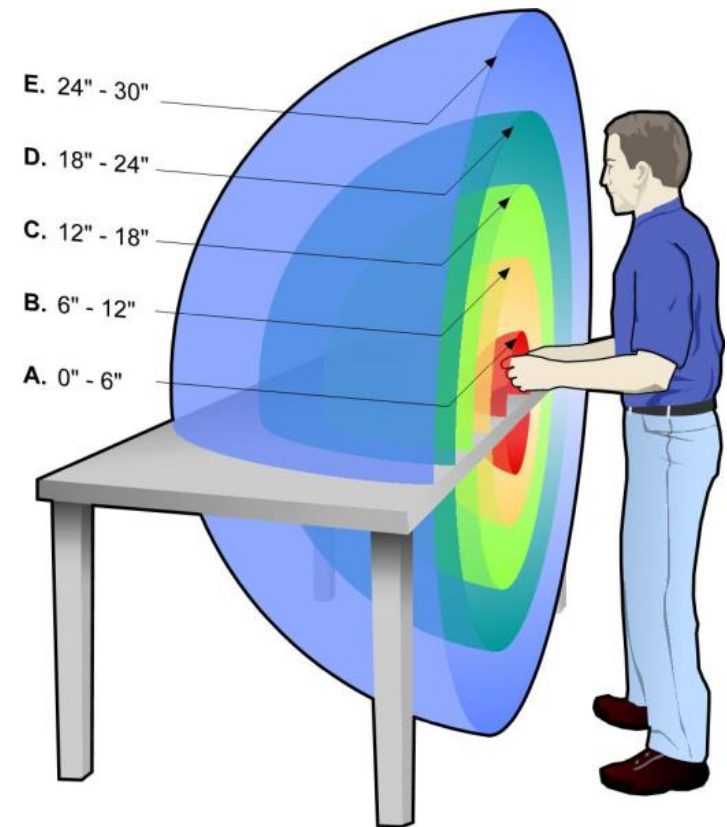


Motion Waste – Reaching and Walking

Cost Justification Worksheet							
Job Name: <input type="text"/>				Current Cycle Time (Sec): <input type="text"/>			
Station: <input type="text"/>				Working Time (Hrs): <input type="text"/>			
Location/Dept.: <input type="text"/>				Daily Shifts: <input type="text"/>			
Product Type: <input type="text"/>				Alike Jobs: 1			
				Hourly Labor Rate (\$/hr): \$25.00			
Job Improvement - Reaching	Current STEP Zone		Proposed STEP Zone		Times per Cycle	MOTION TIME SAVINGS (seconds/unit)	
	Reach From	Reach To	Reach From	Reach To		Projected	Conservative
	Neutral ▼	Neutral ▼	Neutral ▼	Neutral ▼	1	0.00	0.00
	Neutral ▼	Neutral ▼	Neutral ▼	Neutral ▼	1	0.00	0.00
	Neutral ▼	Neutral ▼	Neutral ▼	Neutral ▼	1	0.00	0.00
	Neutral ▼	Neutral ▼	Neutral ▼	Neutral ▼	1	0.00	0.00
	Neutral ▼	Neutral ▼	Neutral ▼	Neutral ▼	1	0.00	0.00
	Neutral ▼	Neutral ▼	Neutral ▼	Neutral ▼	1	0.00	0.00
	Neutral ▼	Neutral ▼	Neutral ▼	Neutral ▼	1	0.00	0.00
	Neutral ▼	Neutral ▼	Neutral ▼	Neutral ▼	1	0.00	0.00
Job Improvement - Walking	Current		Proposed		Times per Cycle	Motion Time Savings	
	First Steps	Next Steps	First Steps	Next Steps		Projected	Conservative
	None ▼	None ▼	None ▼	None ▼	1	0.00	0.00
	None ▼	None ▼	None ▼	None ▼	1	0.00	0.00
Job Improvement - Eliminate Time	Current		Proposed		Times per Cycle	Task Time Savings	
	Task Time (seconds)		Task Time (seconds)			Projected	Conservative
					1	0.00	0.00
					1	0.00	0.00
						MOTION TIME SAVINGS (seconds/unit)	
						Projected	Conservative
						0.00	0.00
TOTAL TIME SAVING S:							

Time Penalties for Reaching

- The STEP methodology uses reach arcs to define 5 zones
- Each reach zone is separated by a 6" (15 cm) increment
- Time penalties for each reach zone vary by 0.2 seconds each and are based on round-trip movements
- Other data you'll need:
 - Time savings per cycle
 - # of cycles per hour
 - Burdened labour costs
 - Current production and quality numbers



Time Penalties for Reaching - Example

BEFORE



- *Associate has to place molded tanks into a cooling jig and clamp in place. Tables had fixed height resulting in reaching, bending to clamp and unclamp tanks. Wrist and shoulder problems were reported (Horizontal distance & hungry head).*

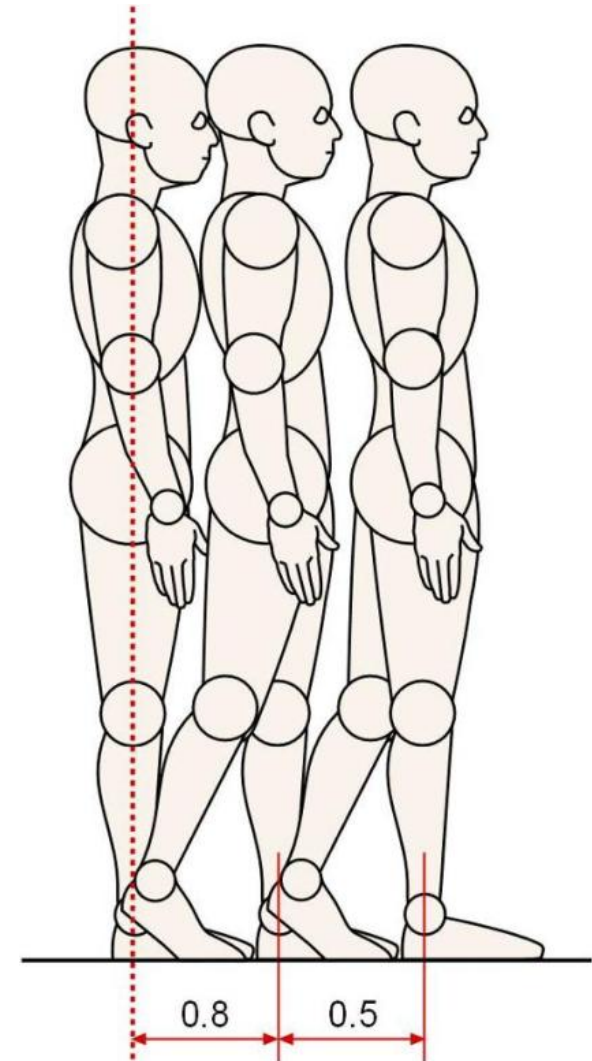
AFTER



- *Input from associates resulted in the design and implementation of height adjustable tables with fans that tilt at an angle. Reach was reduced, posture improved and productivity was improved by 9%. Tank quality also improved from better cooling.*

Time Penalties for Walking

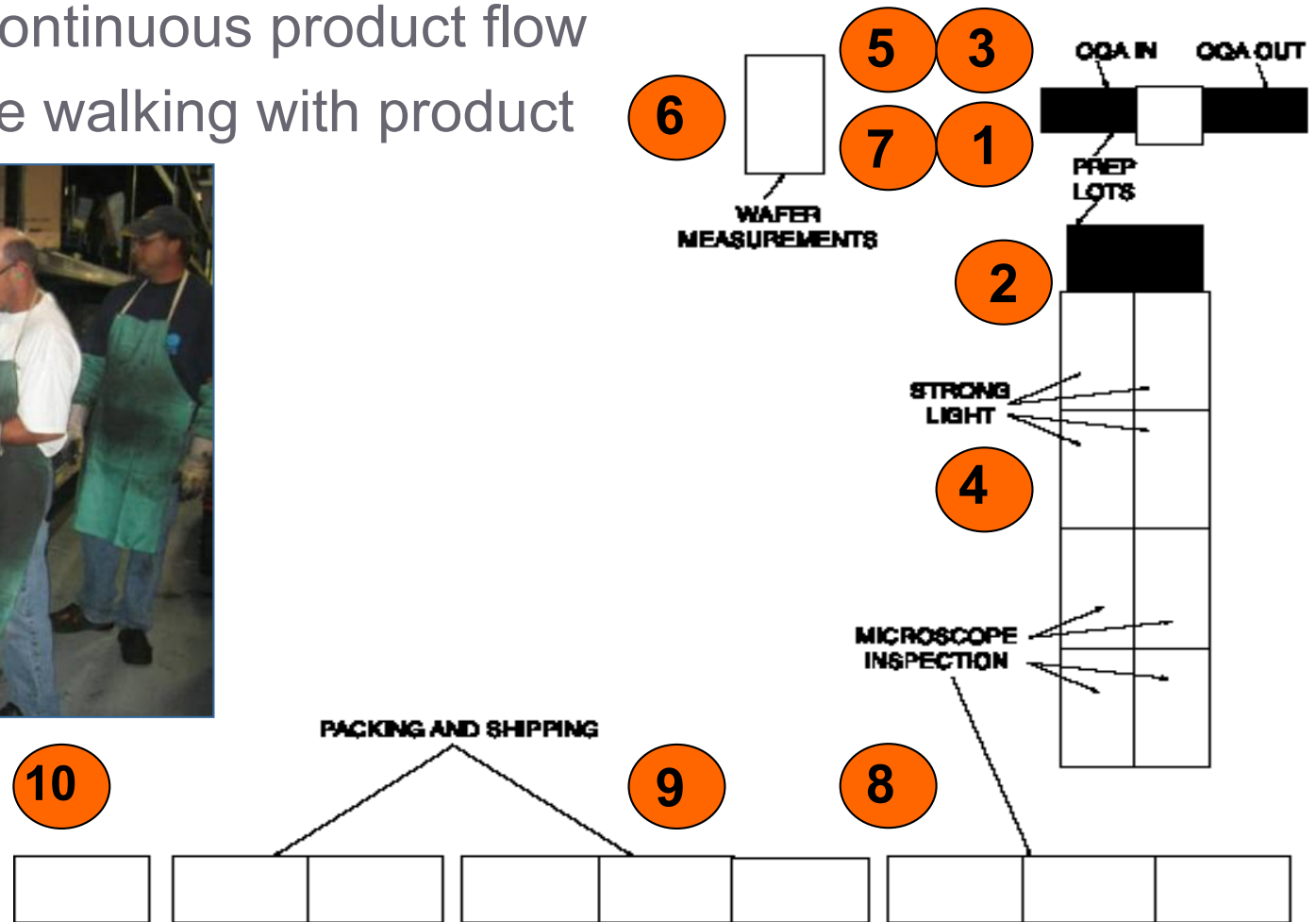
- Time savings are assigned for each step eliminated for walking tasks.
- The first step, using to begin walking, corresponds to 0.8 seconds time penalty.
- Subsequent steps correspond to 0.5 seconds each.



Time Penalties for Walking – Example

- **BEFORE: Poor Layout**

- Lack of continuous product flow
- Excessive walking with product

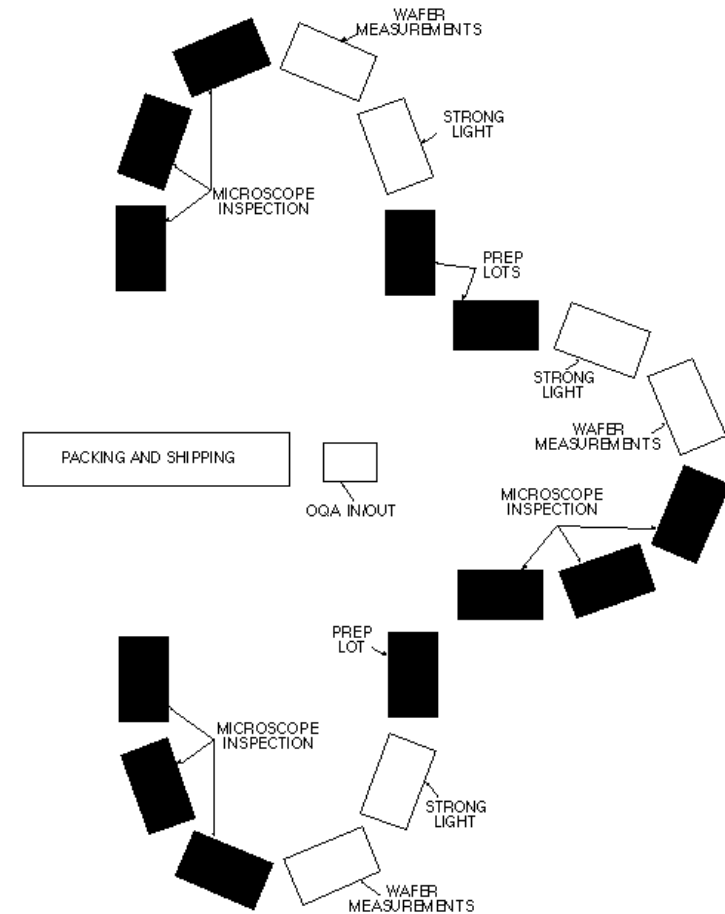


Current OQA/FQA Area Layout

Time Penalties for Walking - Example

- **AFTER:**

- "U" – shaped work cells
- Improved product flow
- Reduced prolonged/multiple handling
- Motion savings = **34.8 seconds/cycle**



New OQA/FQA Area Layout

Check the Effects - Calculating Ergonomics ROI

$$\text{Projected Productivity Impact} = \frac{(\text{total time savings})}{(\text{total operation time})} \times 100 = \boxed{} \%$$

$$\text{Annual Savings} = (\text{productivity impact}) \times (\text{annual direct cost})$$

$$\text{Payback Period (Years)} = \frac{(\text{cost of improvement})}{(\text{annual savings})}$$

Cost Justification – An Example

- There were ergonomic issues when reaching to a torque wrench in this assembly operation. Because there was no previous injury, management didn't see the urgency to improve the job.

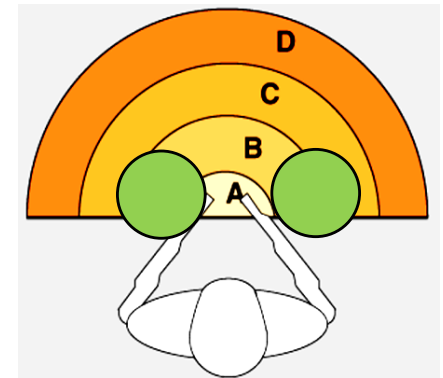
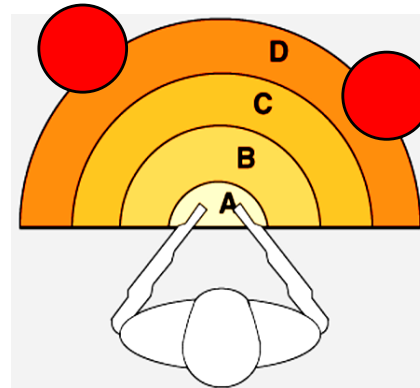


Cost Justification – An Example

Task Element	Value-Added	Non-Value-Added	Ergonomic Risk?	Time (sec.)
1. Reach to screw bin and obtain two screws		✓	✓	1.0
2. Position first screw into part and hand-start		✓	✓	1.2
3. Position second screw and hand-start		✓	✓	1.0
4. Reach to driver and position to first screw		✓	✓	2.4
5. Activate driver to run down first screw	✓			2.2
6. Reposition driver to second screw		✓		1.8
7. Activate driver to run down second screw	✓			2.2
8. Release driver (spring returns)		✓		0.2

Cost Justification – An Example

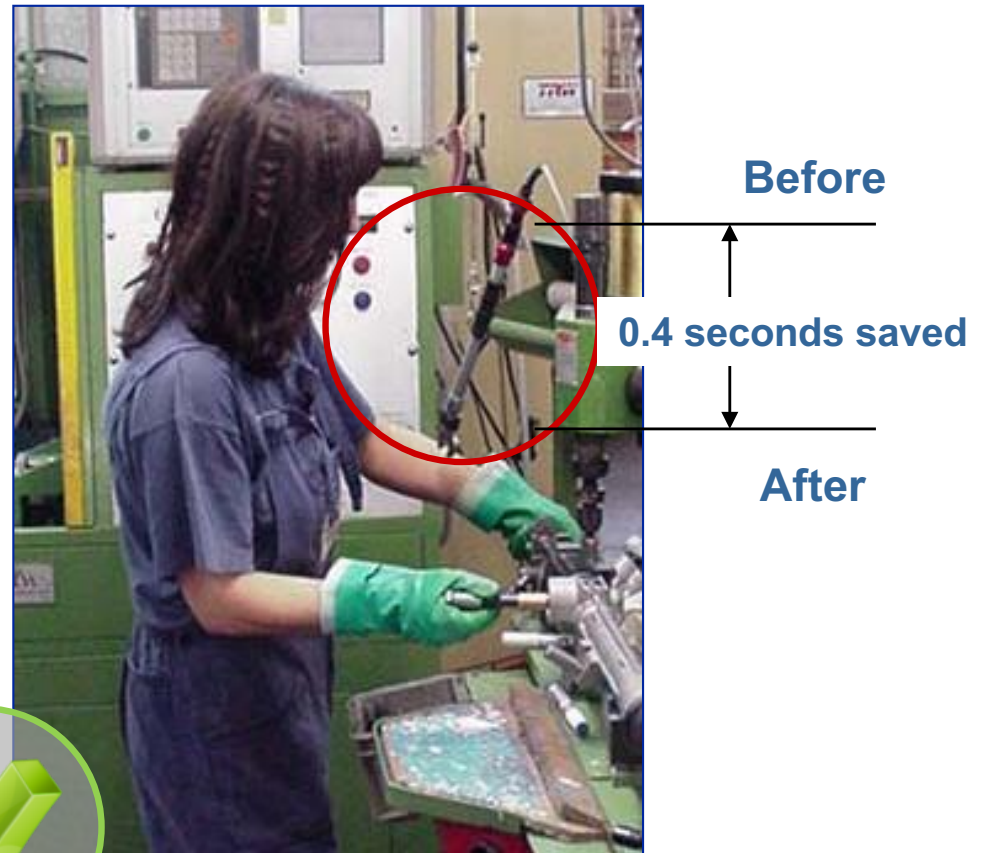
- After brainstorming, the ergonomics team came up with several solutions
- Short term solutions
 - Move bins closer
 - Relocate tool lower
- Long term solution
 - Self-feeding driver



Cost Justification – An Example

Short term solution: Relocate driver and parts bin closer

- The ergonomics team was able to illustrate a 0.4 second time savings that would result by lowering the tool, in addition to improved working postures
- In addition, the screw bin was relocated closer resulting in an additional 0.4 second time savings.
- Cost: \$0



Cost Justification – An Example

Task Element	Value-Added	Non-Value-Added	Ergonomic Risk?	Time (sec.)
1. Reach to screw bin and obtain two screws		✓	✓	1.0
2. Position first screw into part and hand-start		✓	✓	1.2
3. Position second screw and hand-start		✓	✓	1.0
4. Reach to driver and position to first screw		✓	✓	2.4
5. Activate driver to run	✓			0.8
6. Release driver (spring returns)		✓		0.2
7. Push down second screw		✓		0.2
8. Release driver (spring returns)		✓		0.2

Reduce time on tasks by 0.8 seconds
Total time savings = 32 minutes/shift

Cost Justification – An Example

Long term solution: Self-feeding driver

- The ergonomics team wanted to continue with improving the job and investigated installing a self-feeding driver
- Cost: \$2,500



Cost Justification – An Example

Task Element	Value-Added	Non-Value-Added	Ergonomic Risk?	Time (sec.)
1. Reach to screw bin and obtain two screws		✓	✓	1.0
2. Position first screw into part and hand-start		✓	✓	1.2
3. Position second screw and hand-start		✓	✓	1.0
4. Reach to driver and position to fasten		✓	✓	2.4
5. Eliminate 3 tasks = 3.2 Seconds				2.2
6. Total time savings = 128 minutes/shift				.8
7. Activate driver to run down second screw	✓			2.2
8. Release driver (spring returns)		✓		0.2

Cost Justification – An Example



- Self-Feeding Driver
 - Elimination of 3 non-value-added tasks saves a total of 3.2 seconds
 - Cycle time is 12 seconds

$$\text{Projected Productivity Impact} = \frac{3.2 \text{ seconds (total time savings)}}{12 \text{ seconds (total operation time)}} = \boxed{27\%}$$

$$\text{Conservative Productivity Impact} = \frac{2.1 \text{ seconds (3.2 x 0.65)}}{12 \text{ seconds (total operation time)}} = \boxed{17\%}$$

Cost Justification – An Example



- Self-Feeding Driver
 - Conservative productivity impact is 17%
 - Direct labor cost = \$29,000 / year
 - Benefits burden = 25%
 - Cost of the improvement = \$2,500

Annual Savings = 17% (*productivity impact*) x \$36,250 (*annual direct cost*)
= \$6,162

**Payback Period
(Years)** = $\frac{\$2,500 \text{ (cost of improvement)}}{\$6,162 \text{ (annual savings)}}$
= 0.4 years (4.8 months)

Calculating Return on Investment

$$\text{3-Year ROI} = \frac{\text{3-Year Savings} - \text{Initial Investment}}{\text{Initial Investment}} \times 100\%$$

- Self-Feeding Driver
 - Annual savings = \$6,162
 - Cost of the improvement = \$2,500

$$\begin{aligned} \text{3-Year ROI} &= \frac{(3 \times \$6,162) - \$2,500}{\$2,500} \times 100\% \\ &= 639\% \end{aligned}$$

Cost Justification – An Example

Long term solution: Self-feeding driver

- The ergonomics team wanted to continue with improving the job and investigated installing a self-feeding driver
- Cost: \$2,500
- **Payback is less than 4 months!**
- **3-year ROI of 639%**



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What Have We Learned?

- In today's business climate any initiative that does not deliver measurable **value** is an option.
- Ergonomics is an **engineering** issue, not a safety issue
- Most effective way of cost justifying ergonomic improvements is through **production enhancements** (quality, delivery, productivity)
- **Engage all levels** of the organization (management, union, engineering, design, procurement)
- Critical elements for success:
 - Risk based. Data driven.
 - Focus on engineering controls.
 - Cost justification and Return on Investment are key.



Your people matter...



A lot.



ROI of Ergonomic Improvements

Thank you!

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humantech[®]