How *Lean* and *Sustainability* concepts can be integrated and put into practice in a manufacturing environment?

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*LERC Annual Conference*  
July, 2011
In the beginning.....
The GKN story began with the founding of the Dowlais Iron Co on 19 September 1759 in Dowlais, near Merthyr Tydfil in South Wales. Few can have imagined how this small business would develop during the next 250 years.

Today - Engineer and produce special systems and structures:
- Automotive
- Aerospace
- Industrial
- Land systems

Over the past decade GKN established solid foundations for Lean and Environment

GKN was founded in 1759

It was one of first companies to bring the modern industrial age to life:
- 18th : Iron
- 19th : Steel

More 40,000 employees
Operations in more than 30 countries
Sustainability has become a legacy for the 21st century.

It embodies the promise of societal evolution towards a more equitable and wealthy world in which the natural environment is preserved for generations to come.
Examples of Environmental Performance
GKN Driveline Brazil

Environmental Operational Performance
- Energy Improvement Rate (%): 48%
- Water Improvement Rate (%): 78%
- Wastes Improvement Rate (%): 53%
- Recycling Rates (%): 99%

Environmental Management Performance
- Number of years ISO 14001 certification: 11 years - 4 CI cycles
- Number of environmental projects (R&D/technical/CI): 88 - 22 projects/cycles

ISO 14001 OHSAS 18001 Certification
Natural Resources in GKN
Can you recognize these manufacturing wastes?

- Raw Material Wastes
- Chemicals Wastes
- Waste Segregation Wastes
- Water Wastes
- Energy Wastes
Natural Resources in GKN
Can you recognize these manufacturing wastes?

- Oil & Grinding sludge
- Effluent Contaminated Paper
- Hazardous Waste Plastic with Oil
- Energy Compressed Air Water
- Metallic Wastes
Examples - Use of Natural Resources in a process

M(60) Ribs Cell – GKN Aerospace Filton

**INPUTS**
- RAW MATERIAL
- AL
- WATER
- CHEMICALS
- ENERGY
- COMPRESSED AIR
- LIGHTING

**OUTPUTS**
- FINAL PRODUCT
- AL WASTE (SWARF, PIECES)
- USED CHEMICALS
- EFFLUENTS
- CONTAMINATED WASTES
- HEAT
- NOISE
- MOTION

**OPERATIONS**
- MACHINING
- DEBBUR
- FLADDER
- CAD
E-Flows - M(60) Machine Group – Ribs Cell

- **Raw Material / Al**
  - Final Product
  - Al pieces
  - Swarf
  - Chips
  - Metal extraction

- **Energy**
  - Compressed Air
  - Lighting

- **Water & Chemicals**
  - Oils
  - Coolants
  - Contaminate Wastes
  - Effluents
Looking at the Environmental Evolution

The concern about the environment made scholars and society to support the development of a significant number of environmental sustainable practices, with the ultimate goal of supporting growth respecting the resources and the natural systems.

Adapted from Kiperstok. A., 2005
GKN has already chosen to be Lean!

**LEAN ENTERPRISE**

- Lean has a **POWERFUL BUSINESS LOGIC**;
- Lean is **ALL ABOUT PEOPLE**;
- Lean is a **business system** that considers the expenditure of resources for any goal other than the creation of value for the end customer;
- One of the keys to Lean Thinking is **simplification**;
- Lean thinking makes a customer-defined value flow with the aim of **producing less waste**;

- Economic system is not analogous to an ecosystem;
- Ecological concepts in a economic context are not justify – They have different meanings.  

*Prof. Robert Hall, 2008*
GKN has already chosen to be Lean!

GKN Lean organization:
Create a culture of Continuous Improvement where everyone sees the “Flow of Value” and
.....understand their role in it
.....is involved in improving it
.....is able to fix it when it breaks down

The top **500 senior** leaders attend a 6 month “MCIL” programme (Master of CI leadership)

> **300 “SCILs”** – site CI leaders,
> **120 “PCILs”** – Process CI leaders

> Focussing on core Lean tools and developmental areas (Lean & Green, Lean accounting)
How then, lean and sustainability concepts can be integrated and put into practice in a manufacturing environment?

Propose different alternatives for the society

Contributed to create a new world paradigm

Not many have really explored the sustainability side of existent manufacturing strategies

Sustainability practices
How then, lean and sustainability concepts can be integrated and put into practice in a manufacturing environment?

It means looking to environmental issues in other way around...

....Adapting existing manufacturing strategies to support sustainable business.
Can we use Lean to be Green and put it into practice in a manufacturing environment?

> **New logic? Yes!** Looking to environmental issues in other way around;
> **How?** Adapting existing manufacturing practices - **Adapting Lean** to be **Green**;

> **Why?** There are many opportunities for:
> - Improving Environmental Performance, optimizing the use of resources;
> - Save $$$ (money);
> - by focusing in the supporting value streams for the CELL (**Level 1 flow**)

<table>
<thead>
<tr>
<th>LEVEL 1</th>
<th>Production Cell or Line</th>
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<tbody>
<tr>
<td>LEVEL 2</td>
<td>Within the Site</td>
</tr>
<tr>
<td>LEVEL 3</td>
<td>From External Customers through to External Suppliers</td>
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</tbody>
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**The GKN Way**
Lean & Green project for a Cell

**Started:** 2008 by GKN Environmental Team in Brazil;

**Objective:** improve cell supporting flows performance (mass-energy flows - materials, energy and wastes) reducing all wastes, including environmental wastes;

**Expected output:** improvements in these thermodynamic flows (Materials, Chemicals, Water, Waste, Effluent, Energy), contributing for the overall cell performance.
Does Lean & Green work for a Cell: Level 1 flow?

**Green Savings**

- **Total Resources Reduction (%)**
  - GDB Monobloc A: 50%
  - GDB Assembly 20: 40%

**Financial Savings**

- **£132**
  - GDB Monobloc A
- **£15**
  - GDB Assembly 20

*Good pollution prevention strategy*

*Improvement opportunity for saving money*
Some examples of L&G improvement opportunities:

Tripod Cell A – GKN Driveline Brazil

Implementated Actions: Identification and elimination of wastes oil – closed loop: oils are collected returned to the system.

Implementated Actions: Identification and elimination of effluents – dry turning + reuse of wastewater.

Implementated Actions: Identification and minimization of energy wastes – changing in the machine systems.
Can Lean & Green concept be expanded to create a sustainable enterprise?

- The project developed in Brazil has expanded – **GKN Global Team is supporting external research into Lean & Green**;
- Lead manager supported Lean & Green PhD through Cardiff University and UFGRS University in Brazil;
Can Lean & Green concept be expanded to create a sustainable enterprise?

**Vision**
- Reduce Cost
- Improve Quality / Delivery
- Increase $$$
- Customer oriented
- Accomplish legal requirements – **GKN Way**

**What is missing to be sustainable?**
- Focus on Environmental Concern
- Reduce thermodynamic flows
- Focus on eliminating, reducing & recycling

**Lean – Pre / BPE**
- Improve flow of value
- 5 Lean principles
- Continuous Improvement
- Create problem solving culture

**People**
- Employee Involvement
- Learning organization
- Morale
- Safety

**New Business Model**
- GKN Lean & Green Business System

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[Diagram and text content that further explains the Lean and Green concepts, business excellence, and sustainable enterprise models.]
The GKN Way

5. Cope with Kaizen Principals
   Moral, safety, problem solving, employee involvement
   LSW

4. Cope with Lean Principles
   Cost, quality, delivery, profit $,
   customer oriented

4. Cope with Lean Principles
   Avoid 7 classic wastes

4. Cope with Lean Principles
   Value, VSM, flow pull, perfection

3. Cope with Env. Practices
   ISO 14001 - EMS
   Ac. legal req., pollution prevention, CI

3. Cope with Env. Practices
   Cleaner Production
   Eliminate, reduce, recycle

3. Cope with Env. Practices
   Industrial Ecology
   Avoid Env. Stress, thermod. rates

2. Model Basis
   Sustainability - P-P-P
   Profit, Environmental Protection,
   People Involvement

2. Model Basis
   Compression
   Resources shortage, exc.
   consumption, red expansion,
   learning org

2. Model Basis
   Natural Capitalism
   Resources productivity,
   Biomimetism, services
   & flow economy

2. Model Basis
   Lean & Green Basis
   Mass/Energy balance
   Ecosystem #
   Economic System

1. Model Structure
   PDCA

Lean & Green Business Model
Main Inputs

PEOPLE

PLANET

PROFIT

The GKN Way

Expect More
Aims and Objectives of the Research

- The project general goal is developing a **Lean & Green Business Model** for integrating environmental concern and business needs in both site and corporate levels with an ultimate goal of achieving sustainability (focus on People, Profit and Planet);

- Related to specific objectives, **this project will be based in the following items:**
  - Study existing environmental sustainable practices (cleaner production, industrial ecology, ISO 14001, etc), discussing potential benefits and gaps for achieving sustainability;
  - Study Lean as business practice discussing potential benefits and gaps for achieving sustainability;
  - Study and discuss Environmental and Lean practices already applied to GKN, considering:
    - Corporate level;
    - Site level;
  - Apply and discuss (considering costs, performance, required structure, ways of working, advantages and disadvantages) the business model developed to GKN, considering it's 3 levels of flow of value:
    - The Cell;
    - The Factory;
    - Different types of GKN business (Driveline, Aerospace, Sintermetals, Landsystems)
    - The Supply Chain;
  - Review and compare GKN original models and GKN Lean & Green, considering:
    - People and cultural issues;
    - Profit and costs results;
    - Environmental Performance;
Lean & Green concept at GKN

What is the desired change to the business:

- Redesign the system: Use GKN Lean model (GKN Business platform) for deploying a unique and business system, integrating People, Profit and Planet issues;

- Radical use of resources: Use environmental sustainable practices for addressing pollution prevention initiatives integrated to Lean (from the cell level to the extended value stream - overall environmental rating);

- Investing in Natural Capital: Sustaining, restoring and expanding stocks of natural capital by promote continuous improvement for deploying GKN environmental function;

- Improve overall results (environmental, costs, use of resources, etc) in a more focused, business oriented approach.
What is the next Industrial Revolution?

According to the Natural Capitalism text: when Natural Capital - considered as part the system, by:

> **Radical resources productivity**: Slows depletion in one end of the value chain + Lowers pollution in the other end;
> **Biomimicry**: Redesigning industrial systems;
> **Service & flow economy**: Changing consumer and producer relationship;
> **Investing in Natural Capital**: Sustaining, restoring and expanding stocks of natural capital;

Hawken, Lovins & Lovins, 1999
How GKN Lean & Green will support this new challenge?

- **Investing in Natural Capital**: Sustaining, restoring and expanding stocks of natural capital;
- **Biomimicry**: Redesigning industrial systems;
- **Service & flow economy**: Changing consumer and producer relationship
- **Radical resources productivity**: Slows depletion in one end of the value chain + Lowers pollution in the other end

- **Investing in Natural Capital**: Sustaining, restoring and expanding stocks of natural capital;
Closing Remarks

- In the long history of humankind (and animal kind, too) those who learned to collaborate and improvise most effectively have prevailed.

- It is not the strongest of the species that survives, nor the most intelligent that survives. It is the one that is the most adaptable to change.

Charles Darwin
English Naturalist
(1809-1882)