DEPARTMENT OF
MANUFACTURING
ENGINEERING AND
MANAGEMENT

– Implementation of LCA in the early stages of product development.

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Why do LCA?

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- LCA provides a framework for identifying and evaluating environmental burdens associated with the life cycles of materials and services in a "cradle-to-grave" approach.
- LCA systematically identifies and evaluates opportunities for minimizing the overall environmental consequences of resource usage and environmental releases.
- LCA thus helps bridge the gap between product development and environmental improvement.
- Governments and society simply expect that companies pay attention to the environmental properties of all products and LCA and its utilization for product/process improvement is **the** way to meet this demand.

LCA deficiencies

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- Very time consuming and costly, does not support reduced time to market.
- Generally too complex to implement in the product development
- Requires input from environmental experts.
- No methods exist to reuse or update the assessment parameters as the circumstances change.
- Provides a snapshot in time of complex system interactions and therefore does not cater for the dynamic nature of product evolution in the design process.
- Most techniques are first usable after the design is completed and do not support the life cycle evaluation throughout the design process.
- Current environmental evaluation tools support the convergent learning style of scientists.

Research focus

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- ***Develop methodologies and strategies for implementation of LCA in the early stages of the product design (idea or conceptual design phase).***
- ***Analyse CAD-LCA integration approach and restrictions.***

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Eco-design process?

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- Customer and Product Requirements definition.
- Product Fun
- Structural a
- General des
- Detailed de

The EI curve shows that the conceptual

The EI curve shows that the conceptual design phase is very significant in comparison to other phases of the product development with respect to the optimisation of environmental performance.

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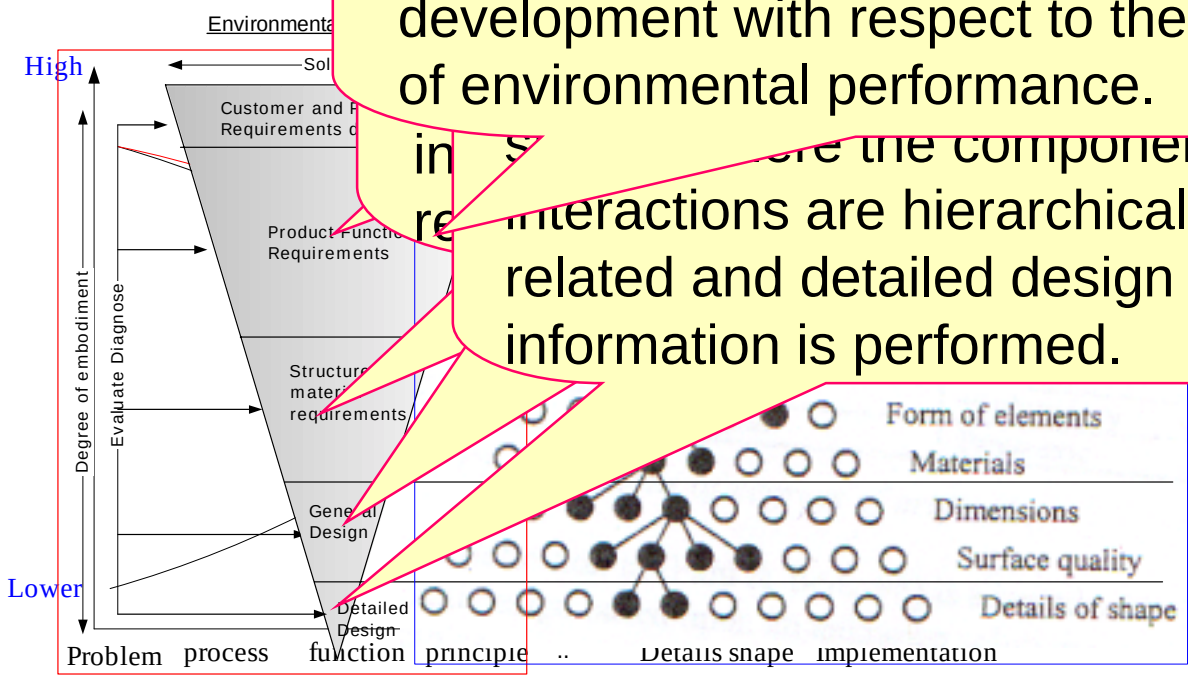
interactions are hierarchically related and detailed design information is performed.



Design for the full Life Cycle

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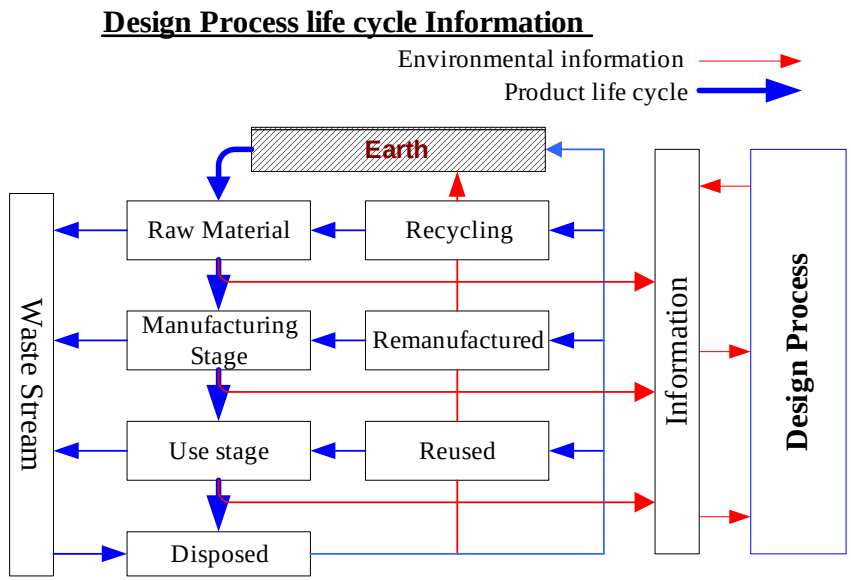
- Life cycle design strategy:
  - design for raw material extraction and recycling;
  - design for manufacture and remanufacture;
  - design for use and reuse;
  - and design for end of life
- Five improvement strategies:
  - better material handling;
  - chemical savings or substitutions;
  - thermal energy economisation;
  - electricity economisation;
  - overhead reduction



Environmental evaluations in the design process

Life Cycle Design strategies

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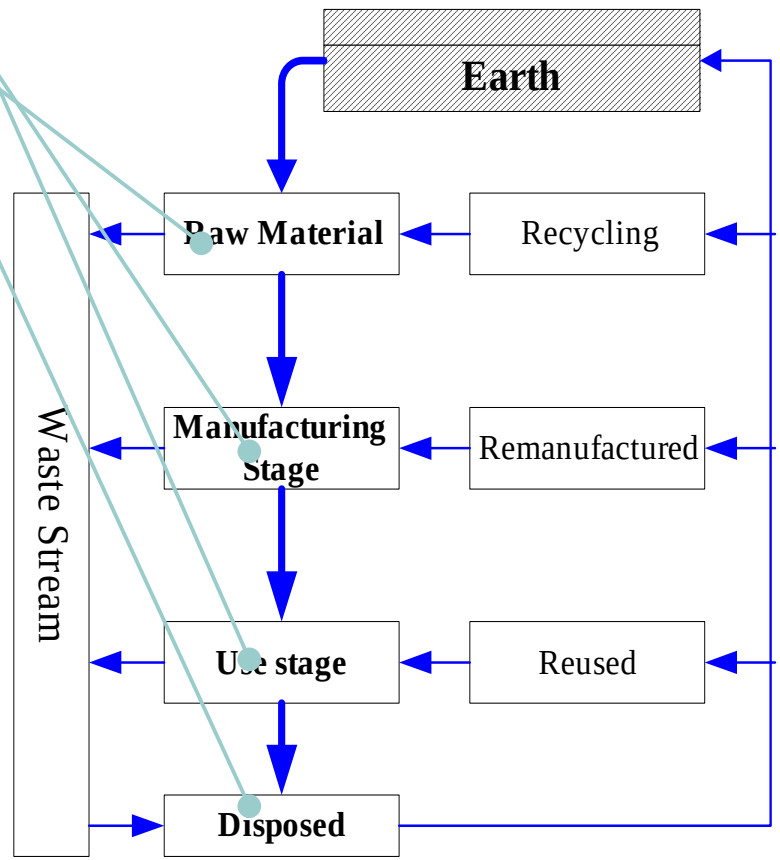
- **Design strategies for use:**
  - Design for energy
  - Design for less emissions
  - Design for physical life;
  - Design for functional
  - Design for increase
  - Design for product's less burden to sub-product.

Life Cycle Assessment



Main issues for product development

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- Information must be accessible and useable and in a form which can be understood by all members of the design team;
- Formal design methods, strategic frameworks and guidelines must be adapted from existing practices, in order to maximise the chances of success in implementation;
- Product developers need help in identifying the environmental issues surrounding the products they are developing;
- Product developers should be aware of the use and benefits of the broad range of eco-design tools and techniques now available, and have the confidence in choosing the most relevant tools for the job;

CAD – LCA integration

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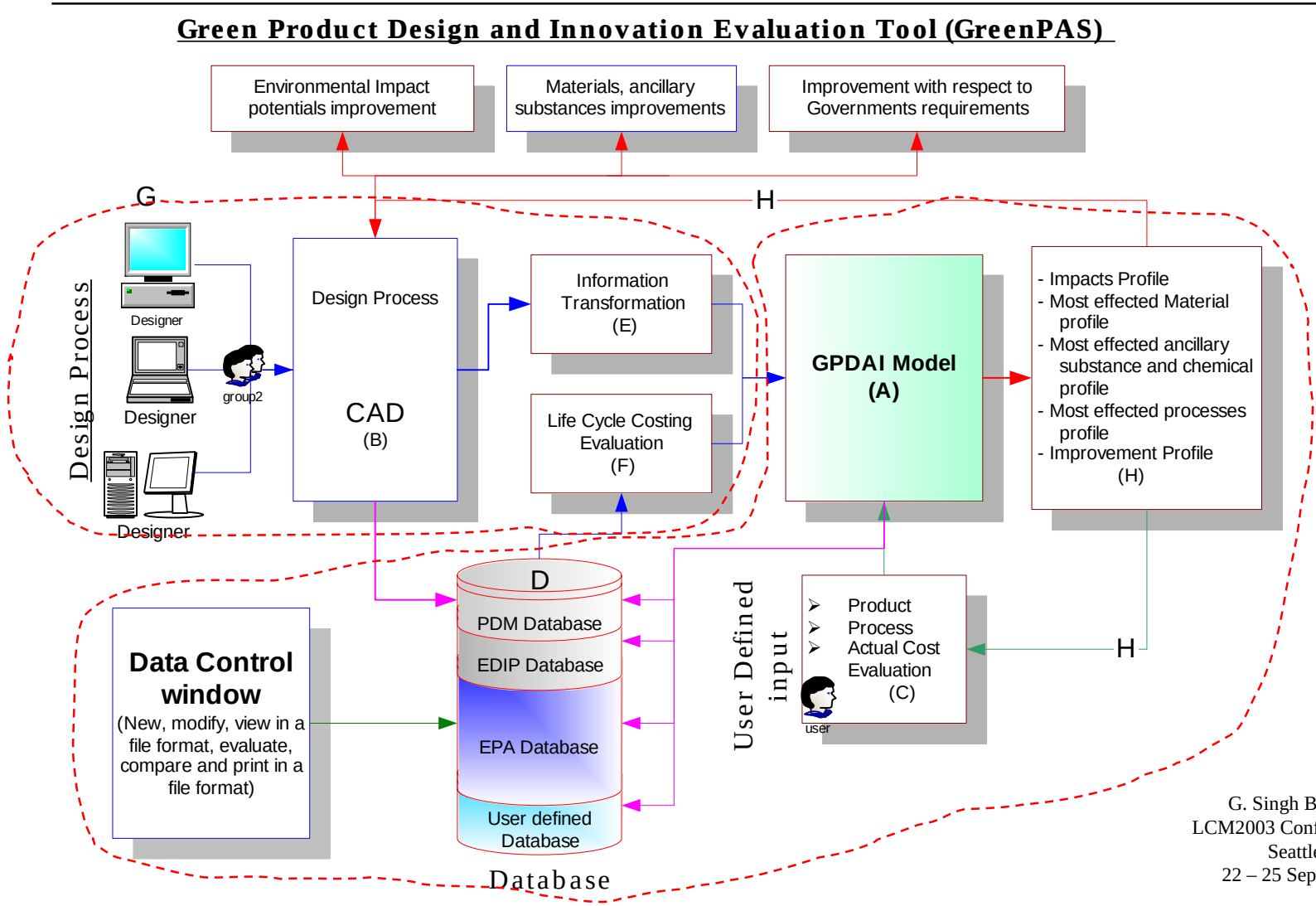

GreenPAS approach?

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- GreenPAS PC tool will help product and system developers to view quick and precise results of the product system. It will also show profiles and scores showing the environmental and cost performance of the chosen product, which will:
  - alert the decision maker or product developer to important choices made during development of the product or system.
  - guide the developer to reduce the environmental score derived from a product.
  - disclose the economic effects for the customer and company and help the company develop a more economic product or system.
  - help to enhance the LCA by improving deficiencies.

Conclusion

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- Sustainable product design requires deeper analyses in the early phase of the product design process than traditional industrial design, which is the focusing point in this presentation;
- The introduction of LCA and industrial ecology forces the product designer to see the product in a wider perceptive;
- A knowledge gap between the environmental scientist and the product designer can be filled through an interface between LCA and CAD systems;
- An interface PC tool, integrated as early as possible in the design process, as well as being integrated throughout the design process could be of great help.