

# Examining the Extent of Environmental Compliance Requirements on Mechatronic Products and Their Implementation Through Product Lifecycle Management

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## Global Ecological Regulatory Interventions

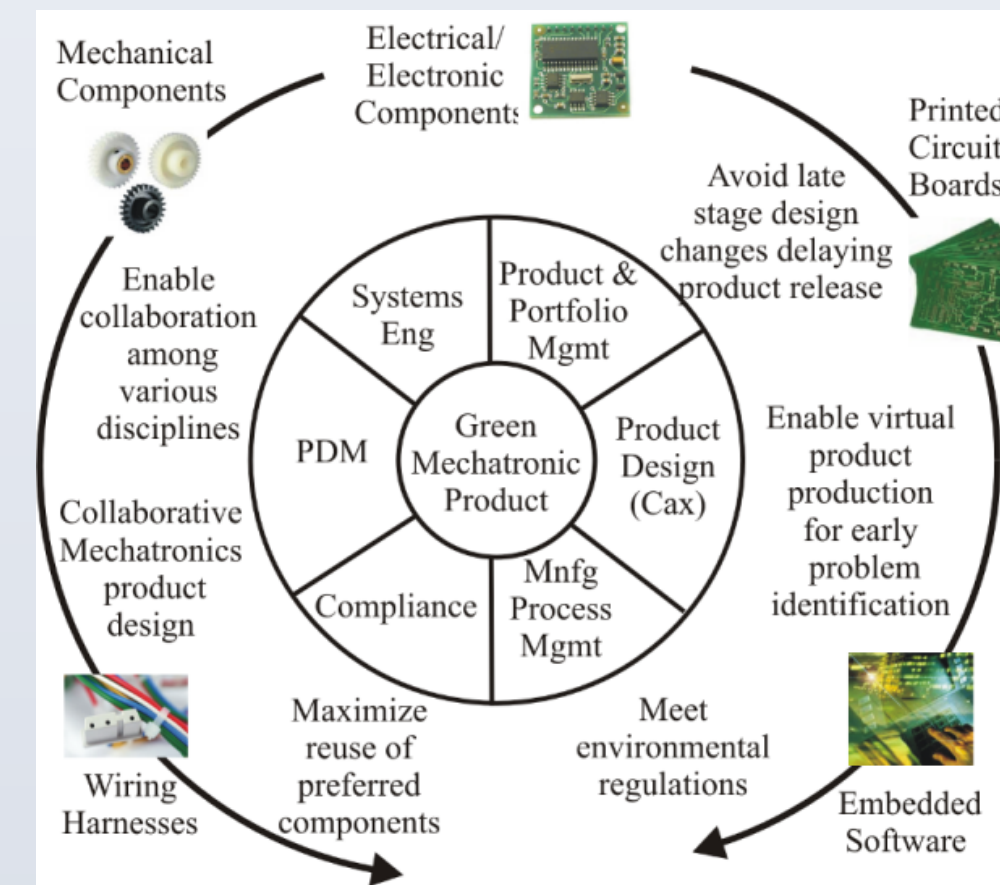


- Increasingly, global ecological regulatory intervention holds manufacturers accountable for damage inflicted on the natural environment by their products.
- Companies are becoming more concerned for the overall ecological footprint of their products.
- This is especially important for most mechatronic products because they all have electronics and embedded systems

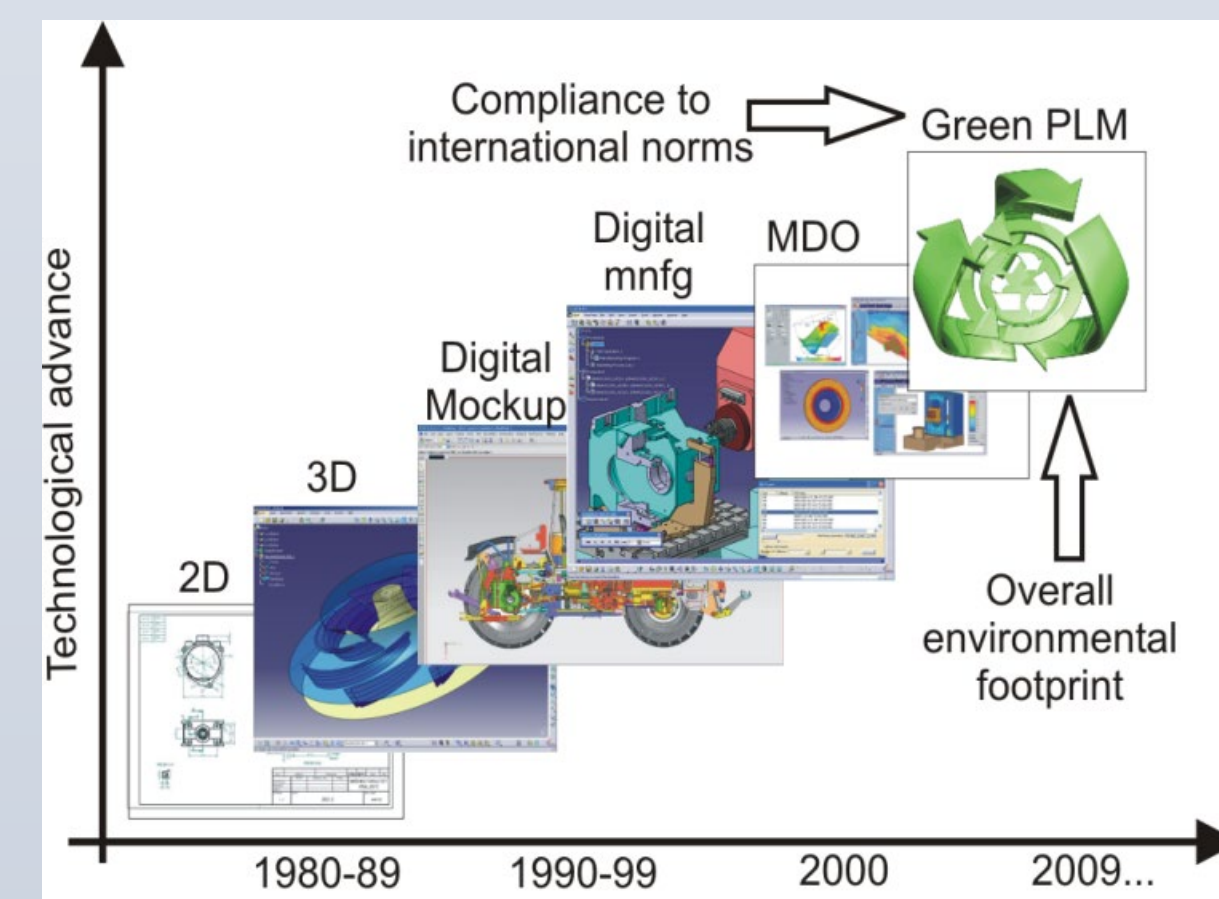
- Extended Polluter Responsibility (EPR) Policy
- European Union, China & Japan
- Waste Electrical and Electronic Equipment Directive
- Ordinance on the Avoidance of Packaging Waste
- Green Dot waste reduction program
- European Directive for Energy-Using Products (EuP)
- RoHS- Restriction of Hazardous Substances Directive

### Design Requirements

- Managing development of these complex systems over the entire product lifecycle is a big challenge for all manufacturers and their suppliers.
  - Software and electronics
  - Manufacturing
  - Safety needs
  - Assembly
  - Serviceability
  - Style
  - Features
  - Price

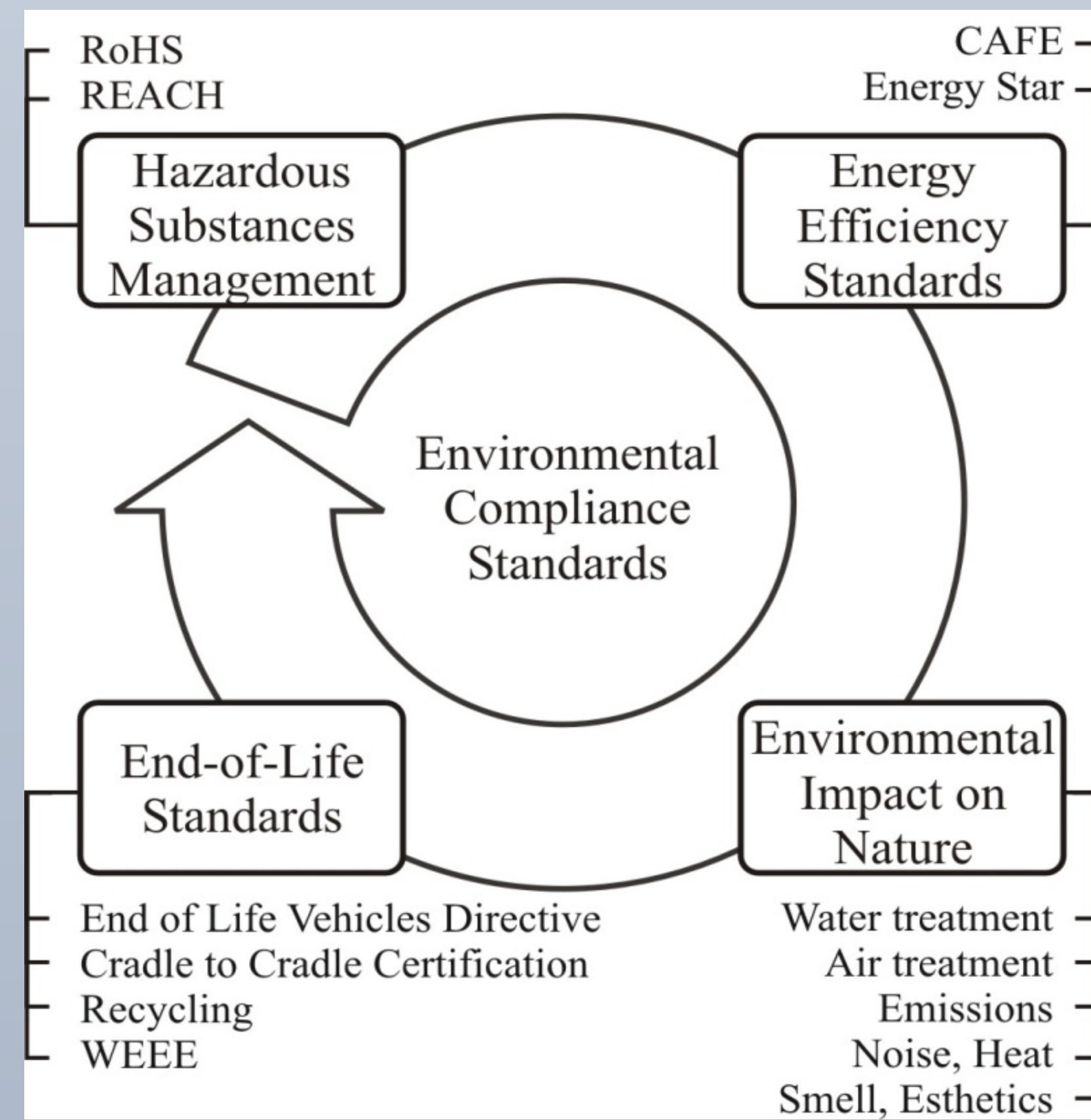


- But also for
  - Service
  - Disassembly
  - Reuse
  - Recycle
  - Environment
  - Disposal

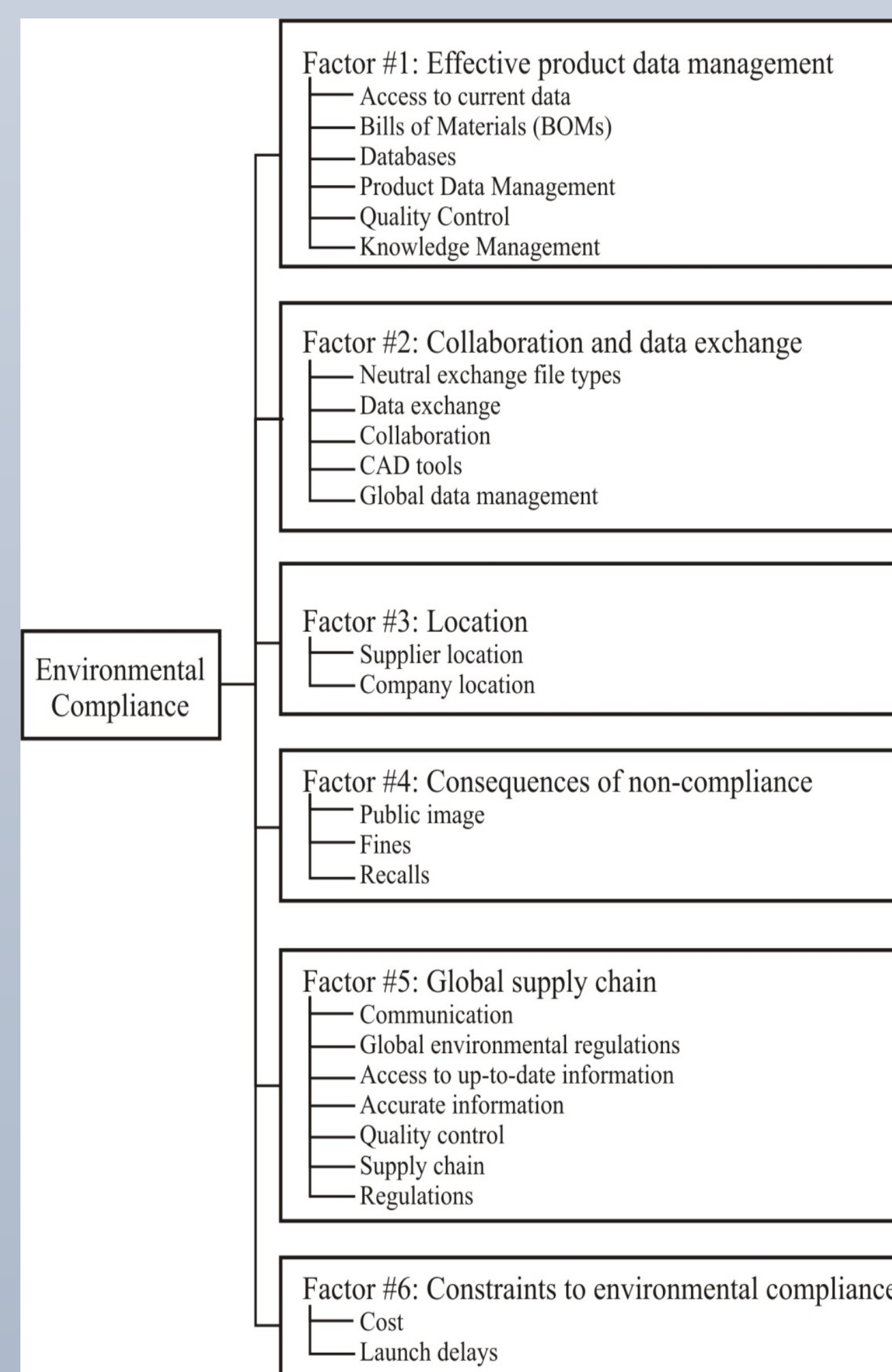


## PLM and Mechatronics

- Design for compliance
- Management of hazardous and controlled substances
- Regulatory and compliance documentation
- Managing recyclables and controlled waste



## Environmental Compliance Factors



## PLM Software & Mechatronics Products

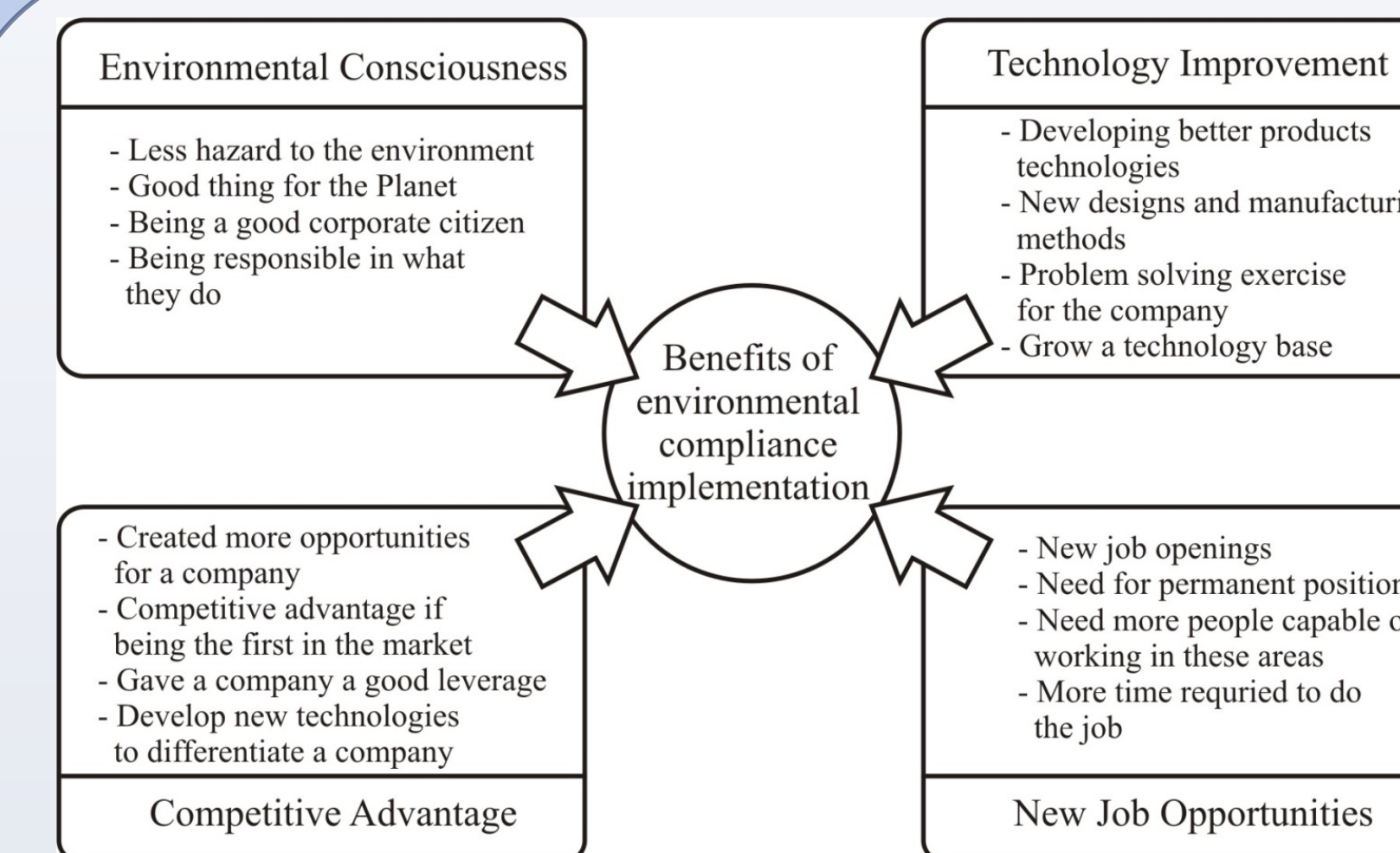
	Dassault Systemes	Siemens PLM Software	PTC
Systems Engineering (SE)	DSS Solution for SE	Teamcenter	ProjectLink
Product and Portfolio Management (PPM)	3DLive Enovia	Teamcenter Community	PDMLink
Product Design (CAx)	Catia	NX	Creo
Manufacturing Process Management (MPM)	Delmia	Technomatix	Intralink
Product Data Management (PDM)	Enovia	Teamcenter	Windchill
Compliance	ENOVIA Materials Compliance Central	Siemens PLM Software Regulatory Compliance	Environmental Compliance Solution

Compliance with Environmental Standards	% of Respondents
Standards that relate to components that participants' companies design and manufacture	
ISO 9000	54.4
ISO 14000	12.6
Emissions standards	15.5
Other	29.1

Company must comply with environmental regulation:	% of Respondents
Electronic Waste Recycling Act	12.6
Clean Air Act	33.0
RoHS	45.6
WEEE	14.6
CARB	8.7
Other	16.5

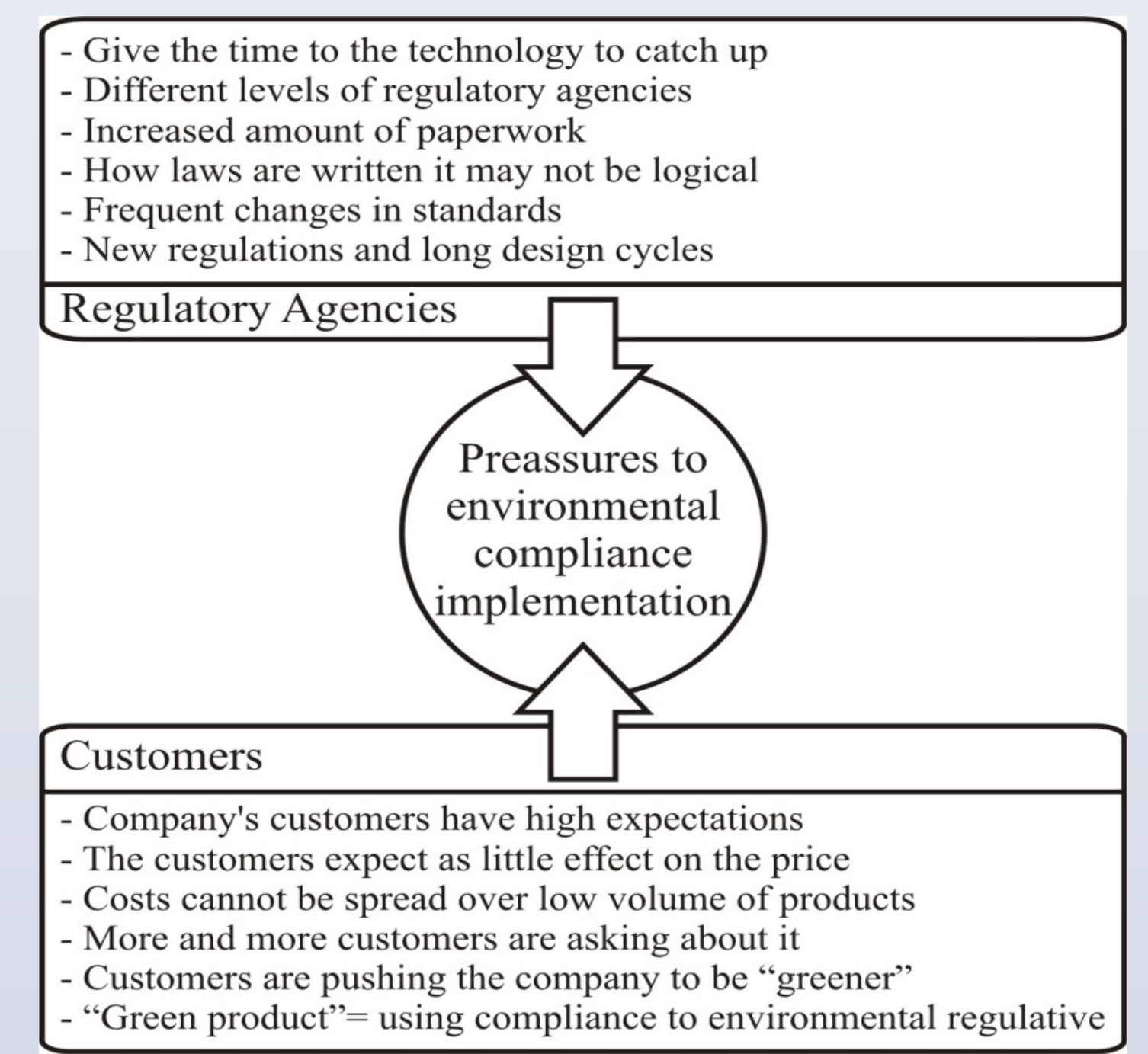
Company has to comply with environmental regulation - Other:	% of Respondents
REACH	4.9
EPA	3.9

Substance management is needed for the following substances	% of Respondents
Cadmium	14.6
Hexavalent chromium	16.5
Lead	23.3
Mercury	12.6
I do not know	22.3
Other	10.7

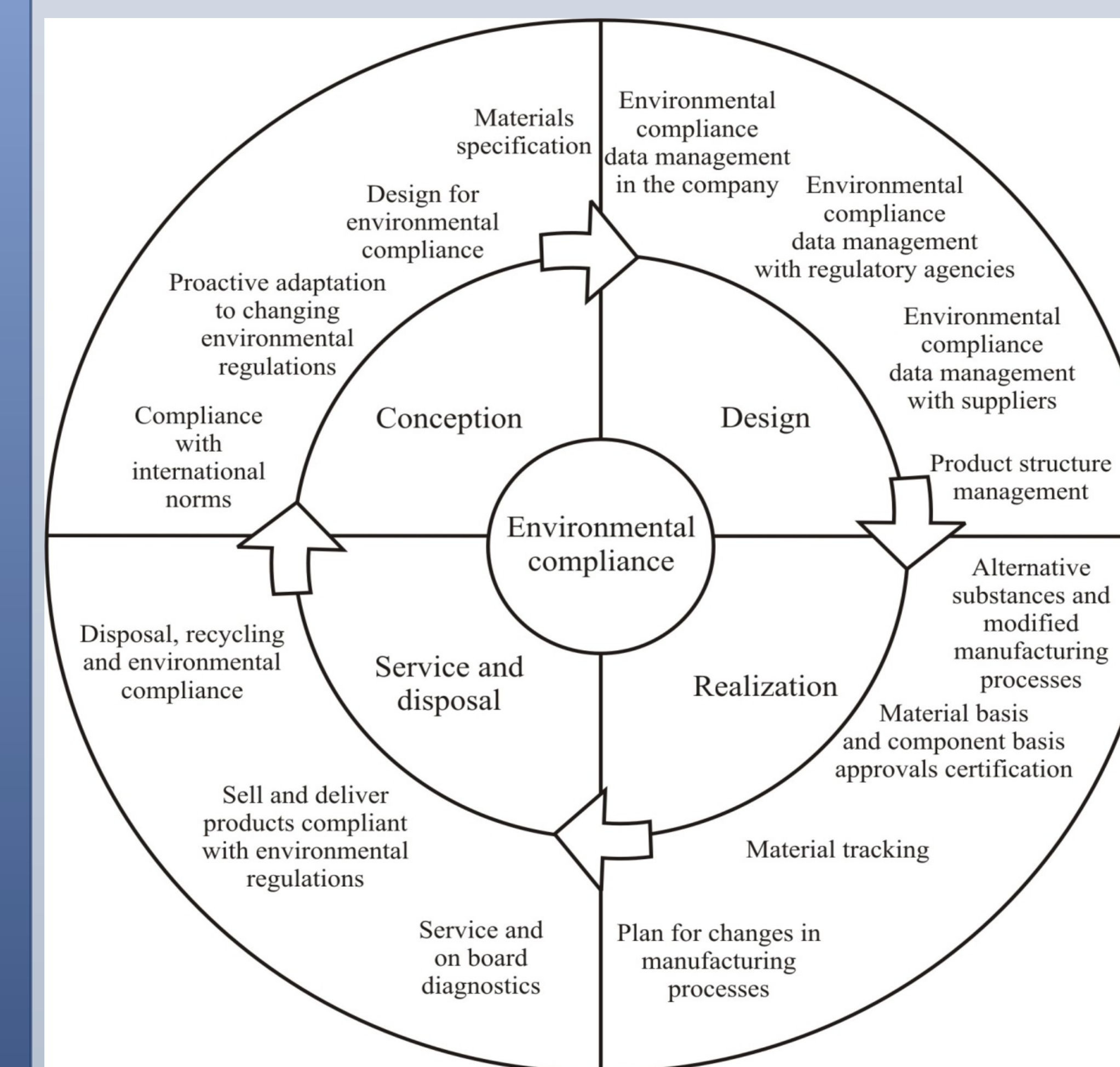


- Various themes emerged from narrative data that were related to environmental compliance regulations and benefits related to their application to mechatronic product design and manufacturing.

- Implementing environmental compliance requirements in a company's design process is difficult. One category that emerged from the narrative data were related to the problems of implementation of environmental compliance requirements into design and manufacturing processes.
- There were various problems were identified by participants in the study as things that were occurring while their company was attempting to implement those requirements in their product with given resources.



## Product Lifecycle Management and Environmental Compliance of Mechatronic and Electromechanical Products



"How are Product Lifecycle Management software tools used to facilitate environmental compliance of mechatronic and electromechanical products?" Based on the Product Lifecycle theory, identified themes were grouped into product lifecycle phases: conception; design phase; realization; and service and disposal. Based on the data from qualitative portion of the study, Product Lifecycle Management tools typically are utilized to enable material tracking of hazardous substances in the company at the design phase.

## References

Jovanovic, V. (2010). Examining the extent of environmental compliance requirements on mechatronic products and their implementation through product lifecycle management. Purdue University.

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