



Wheel-model of Systems Engineering Knowledge Areas

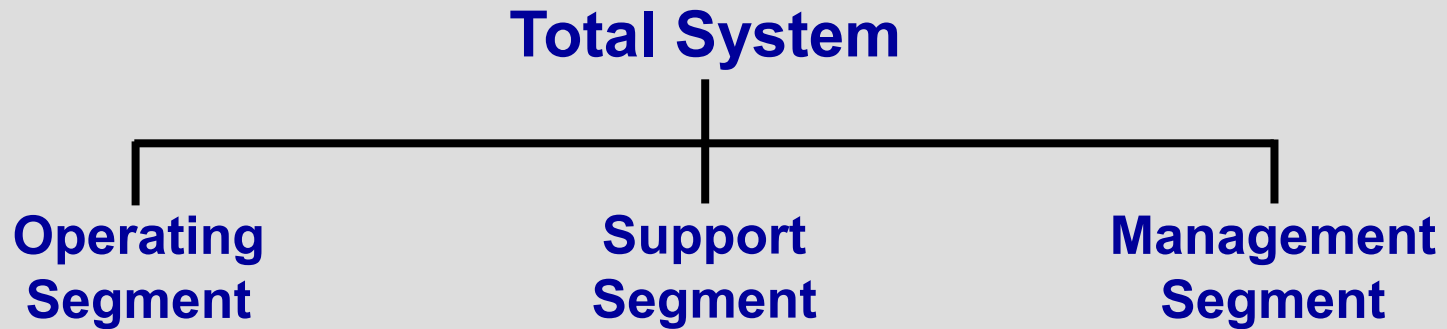
Release 2.6

**by
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Standard Systems Hierarchy

System	
<u>Level</u>	<u>Level Name</u>
9	Global Systems
8	Societal Systems
7	Enterprise Systems
6	Business Systems
5	System Segments
4	Items
3	Modules
2	Components
1	Constituents

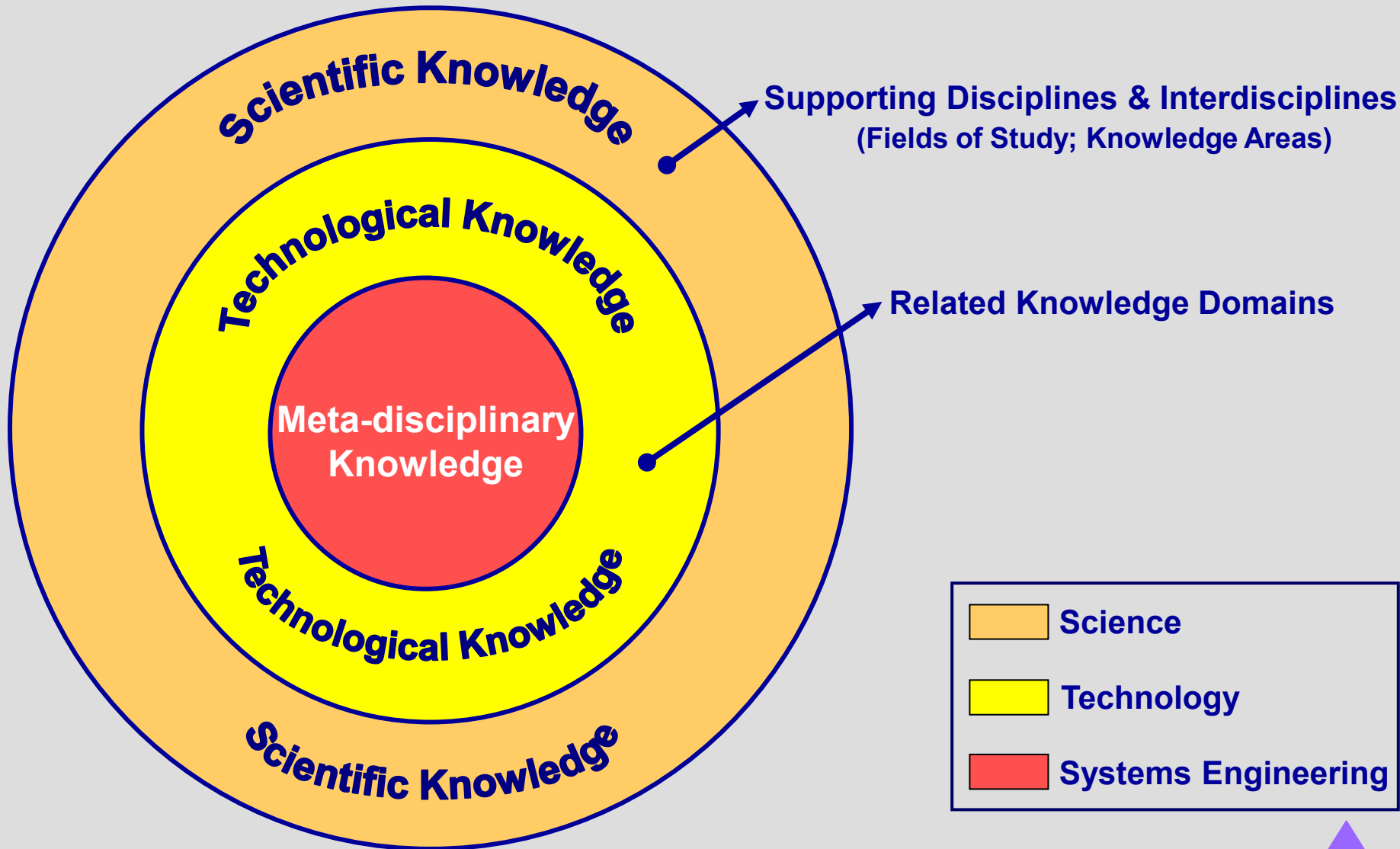
The Concept of a Total System



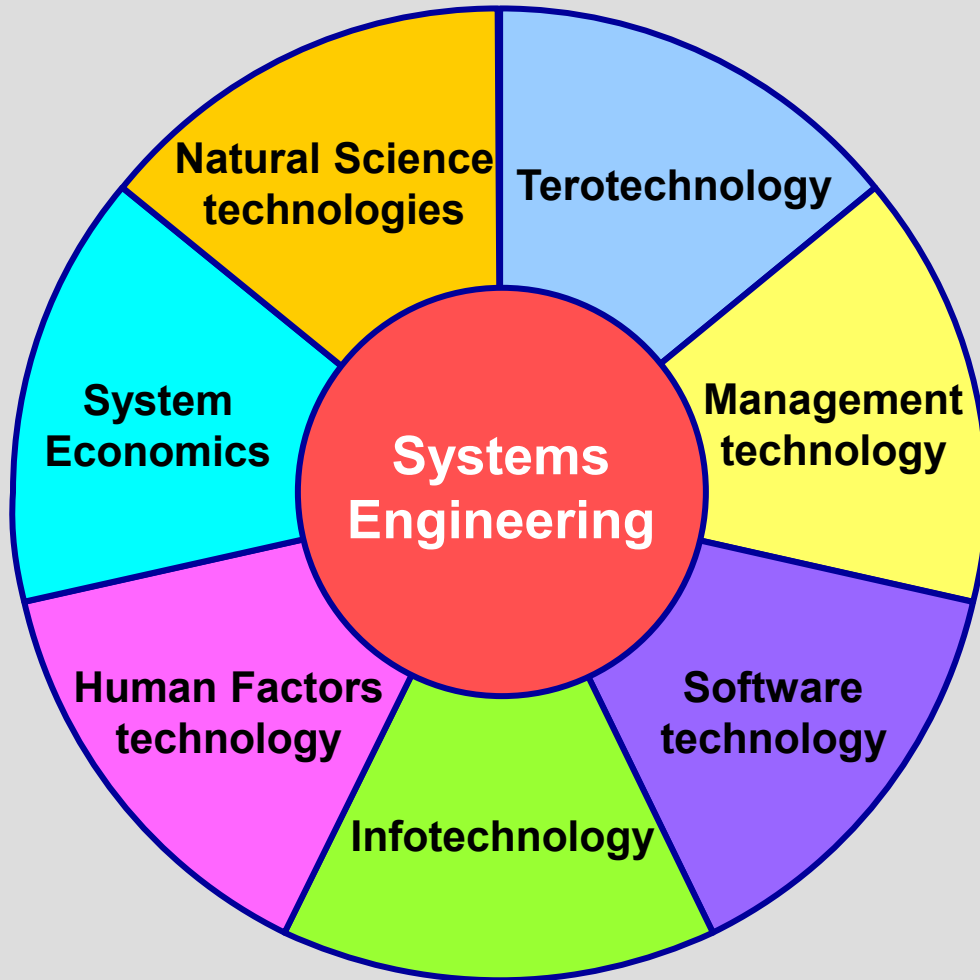
Total Systems are built from 7 Generic System Elements:

- **Hardware (hw):** equipment used in operating, support and management of the system
- **Infraware (iw):** infrastructure, installations, facilities, amenities, etc.
- **Software (sw):** operating programs, application programs, middleware, firmware
- **Bioware (bw):** people (e.g. users, operators, maintainers, managers)
- **Dataware (dw):** documents (e.g. specifications, drawings, plans, manuals), data files and databases
- **Consumaware (cw):** consumables (e.g. fuels, lubricants, coolants, cleansers, paper, steam, clothing)
- **Services (ss):** maintenance, cleaning, transport, dataware updating services, etc.



Related Knowledge and Supporting Disciplines



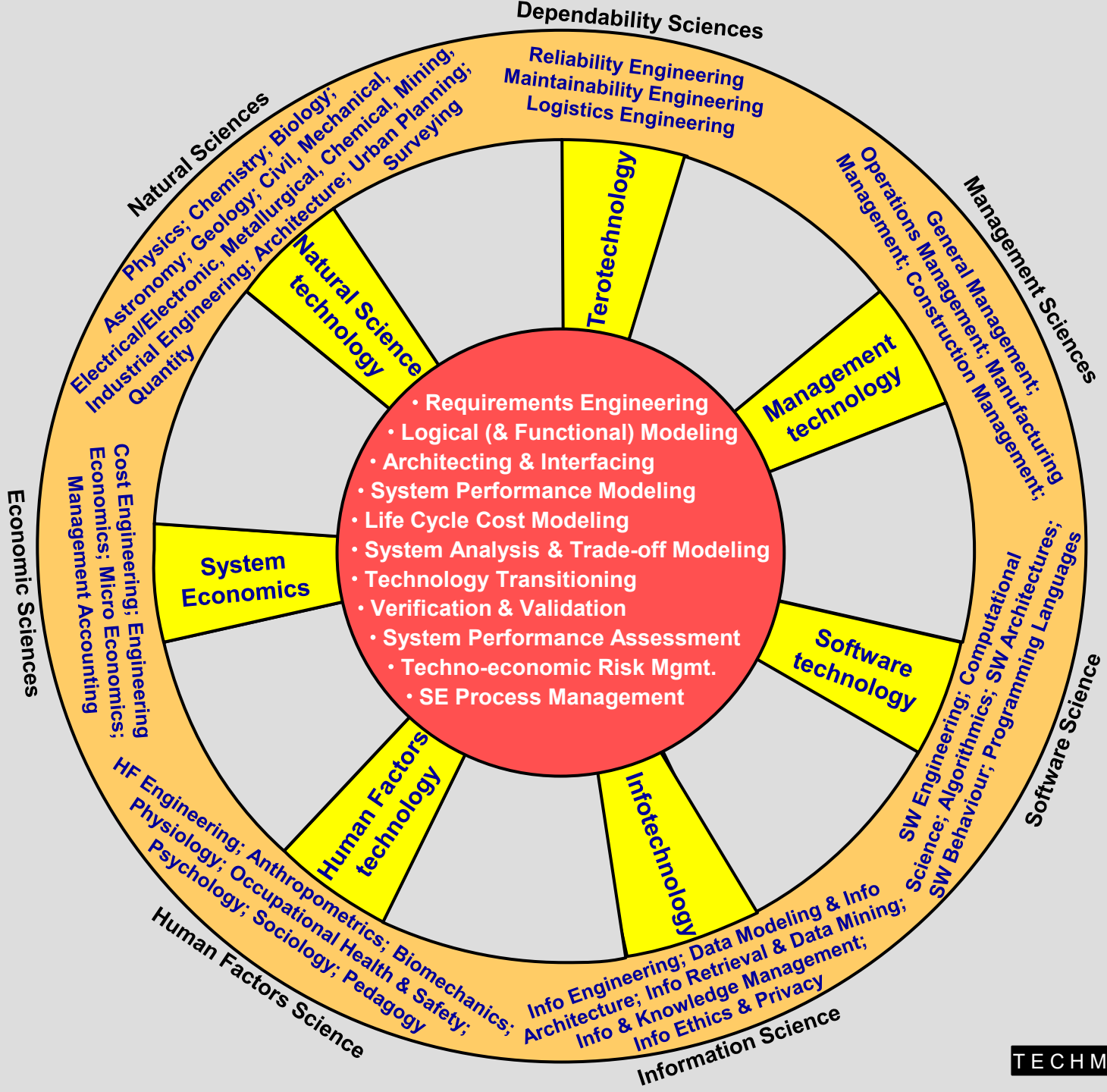
Related Knowledge Domains



Most modern Total Systems include aspects from all 7 knowledge domains!

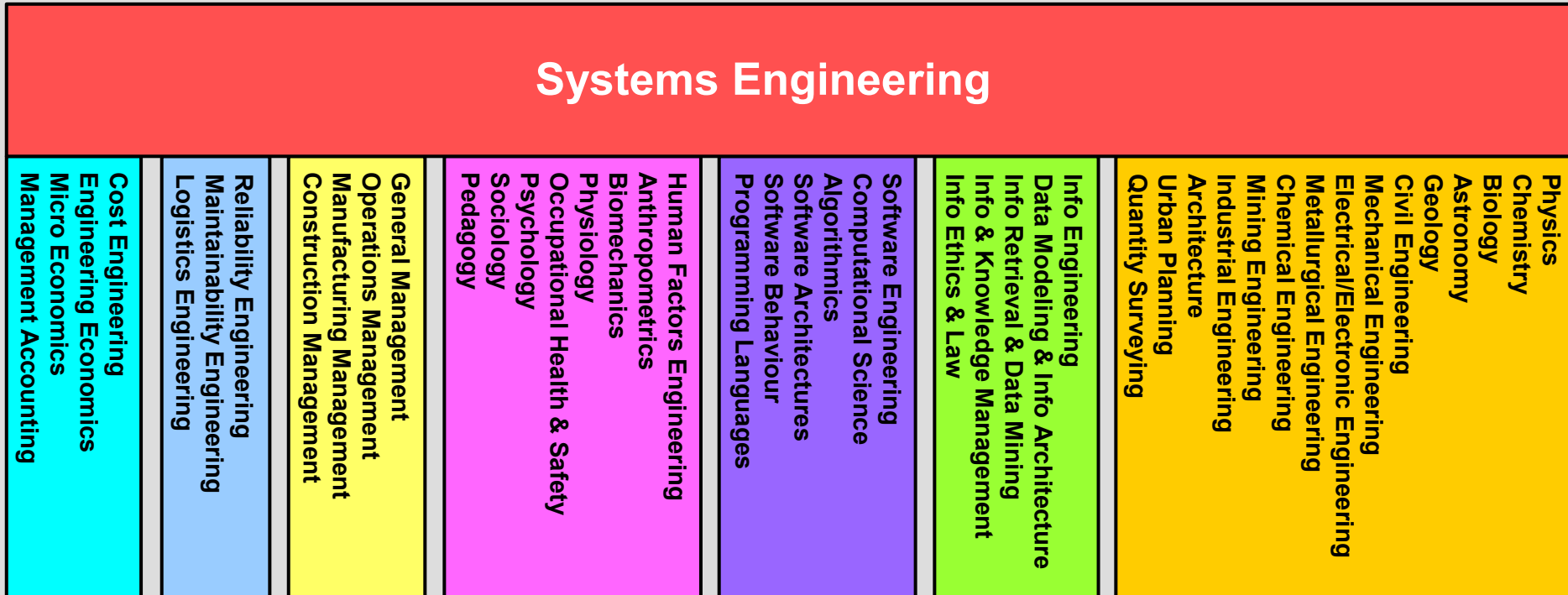
-  SE applies knowledge (technology) from the 7 domains to realize successful Total Systems.
-  SE integrates the efforts by the detail discipline functionaries from the 7 domains.

SE Knowledge Areas in Context



Systems Engineering as Meta-discipline

Systems Engineering



The 8 science groups: Natural Sciences; Dependability Sciences; Management Sciences; Software Science; Information Science; Human Factors Science; Economic Sciences; Systems Science

The Wheel-model Explained

The graphic of a cart wheel (consisting of rim, spokes and hub) is used to reflect the SE Body of Knowledge (SE BoK) within context of supporting fields of study.

Rim of the wheel:

- applicable sciences (e.g. Physics) and applied sciences (e.g. Mechanical Engineering)
- relevant interdisciplines (e.g. Biochemistry, Mechatronics Engineering) and domain-centred disciplines (e.g. Telecommunications Engineering, Aerospace Engineering, Computer Engineering) are part of this component of the model (although not shown here)

Spokes of the wheel:

- the seven broad technological knowledge domains that represent the related knowledge of SE
- each of the seven knowledge domains is elaborated in a general framework (not included here)

Hub of the wheel:

- the eleven knowledge areas that represent the core knowledge of SE
- these knowledge areas are inclusive of management/maintenance activities, for example, Requirements Engineering includes Requirements Management
- systems science (systemology) supports the eleven core knowledge areas fundamentally

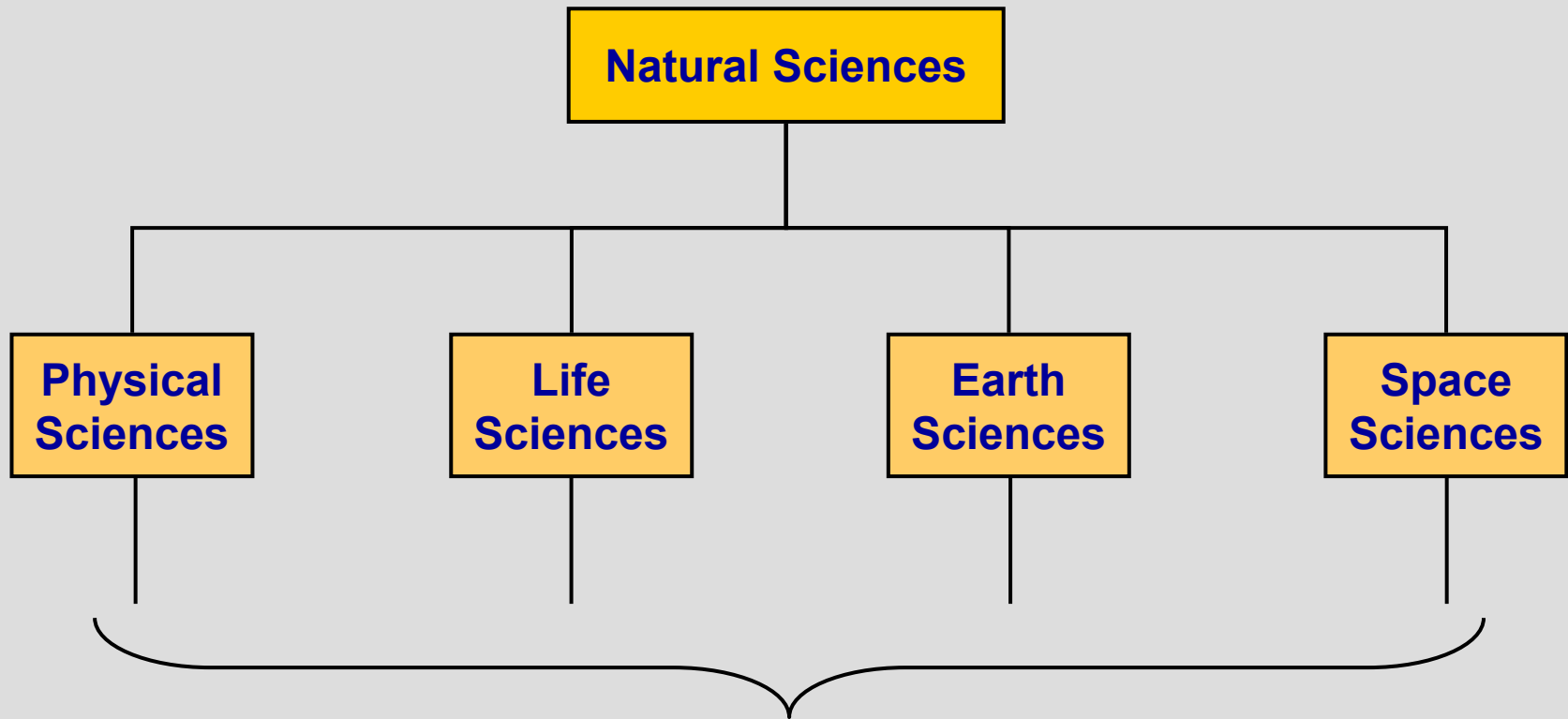
Application of the Wheel-model:

- the model applies to the complete spectrum of human-made systems, from predominantly hardware-based systems to mainly software systems
- for application to System Level 7 enterprises and higher level systems it may be necessary to add management fields of study such as HR & IR Management, Organizational Behaviour, Procurement Management, Financial Management, Quality Management, Technology Management, etc.



Alternative Taxonomies for the Fields of Study

Alternatives are recognized and they may serve the purpose equally well.
Here is one example:



**Science and Applied Science disciplines &
Interdisciplines and Domain-centred disciplines &
Subdisciplines thru to Specialisms**