



BURDEN OF FUTURE STUDIES' EXPERIENCE

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FUNDAMENTAL CHALLENGES

- **Growing Complexity**
- **Accelerating rhythm of evolution**
- **Growing uncertainties**
- **New role of different stakeholders**



SCIENTIFIC FOUNDATION

- **Chaos and Complexity**
- **Evolutionary Theory**
- **Cycles theory**



EXPERIENCE: S&T FORESIGHT (1980s)

- **20- years horizon**
- **Linkages between Economic, social, environmental and S&T frontiers**
- **2500 research organizations**
- **56 volumes**
- **Human capacity building**

EXPERIENCE: S&T FORESIGHT (1980s)

- Legislative framework
 - Responsibility of governmental and scientific structures
 - Information flows
- Organizational framework
 - Scientific Council- a place for the dialogue between policy- makers and scientists
 - Departments in the Ministries
 - Research capacities



EXPERIENCE: S&T FORESIGHT (1980s)

- **The stages of Foresight program development**
 - 1st year: methodological
 - 2nd year: analytical
 - 3rd year: 20- years horizon
 - 4th year: 10- years horizon
 - 5th year: short- term plans
- **Incorporation into decision making process**
- **From long- term perspective to the actions to shape the future**
- **Common team (GEO UNEP)**

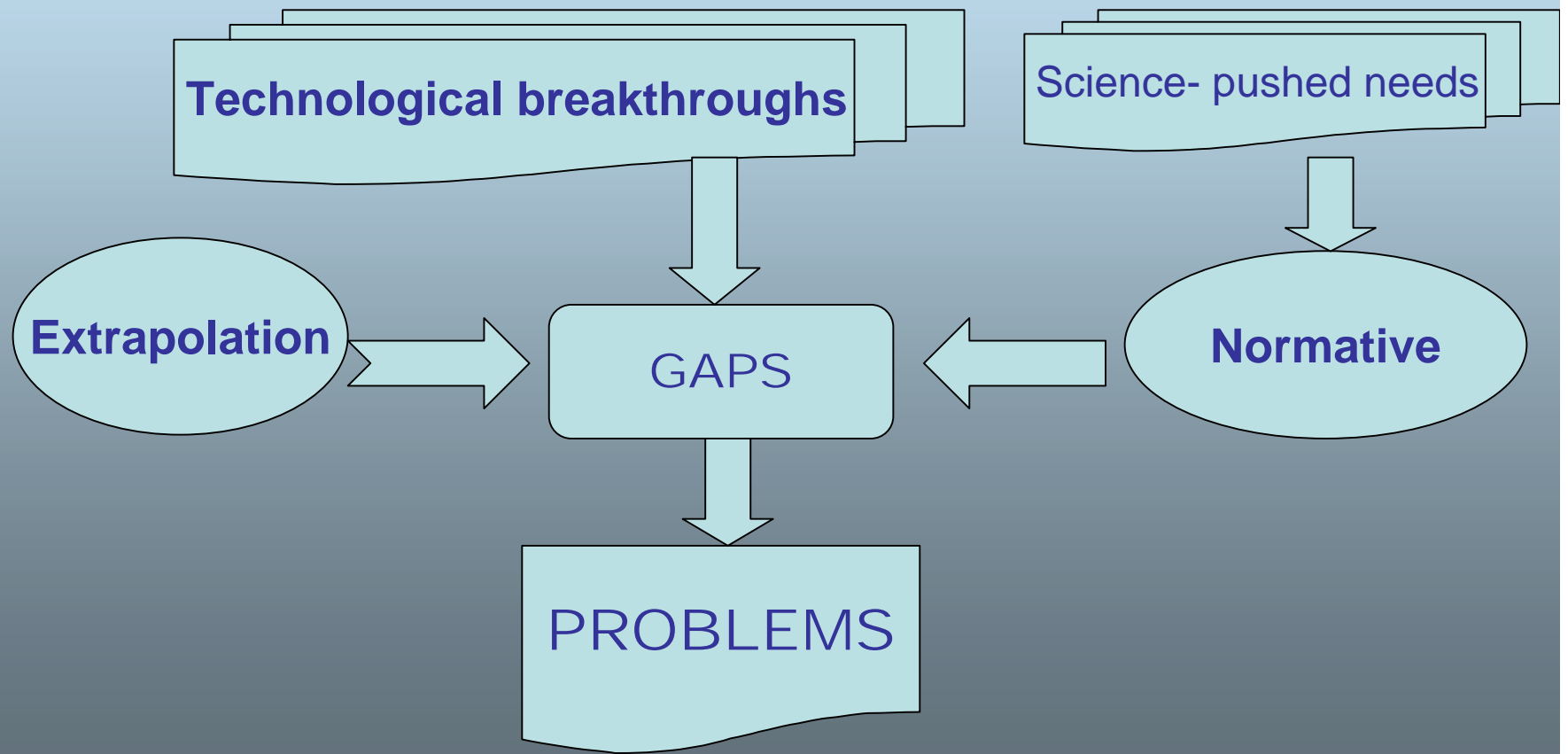


EXPERIENCE: S&T FORESIGHT (1980s)

- **Analytical Stage**
- **Evolutionary and Cycles Theory:**
 - *internal changes might be resulted in taxonomy change*
 - *Inherent uncertainties*
 - *System behavior is non-linear*
- **Conditions of development and internal changes**
- **Hot spots**

EXPERIENCE: S&T FORESIGHT (1980s)

Long- term horizon



CHALLENGES TO THE EXPERIENCE

Extrapolation

Regression

Simulation

Input- output

Complexity & Chaos Theory:

... at the branch point system's trajectory is changing (correlations?), system's pattern and entities behavior is changing (causal & effect)



CHALLENGES TO THE EXPERIENCE **Extrapolation**

Unstable systems at the brunch point

- The correlations between parameters change dramatically
- System's pattern change
- Behavior of system's entities change

CHALLENGES TO THE EXPERIENCE

Agent- multy- agent models

Chaos & Complexity and Evolutionary Theories

- *Behavior of system's entities change*
- *New role of self- organization*

CHALLENGES TO THE EXPERIENCE

Agent- multy- agent models

- Learning and changing behavior of agent
- Self- organization of agent

Chaos & Complexity

Increasing complexity of systems

Chaos Collapse

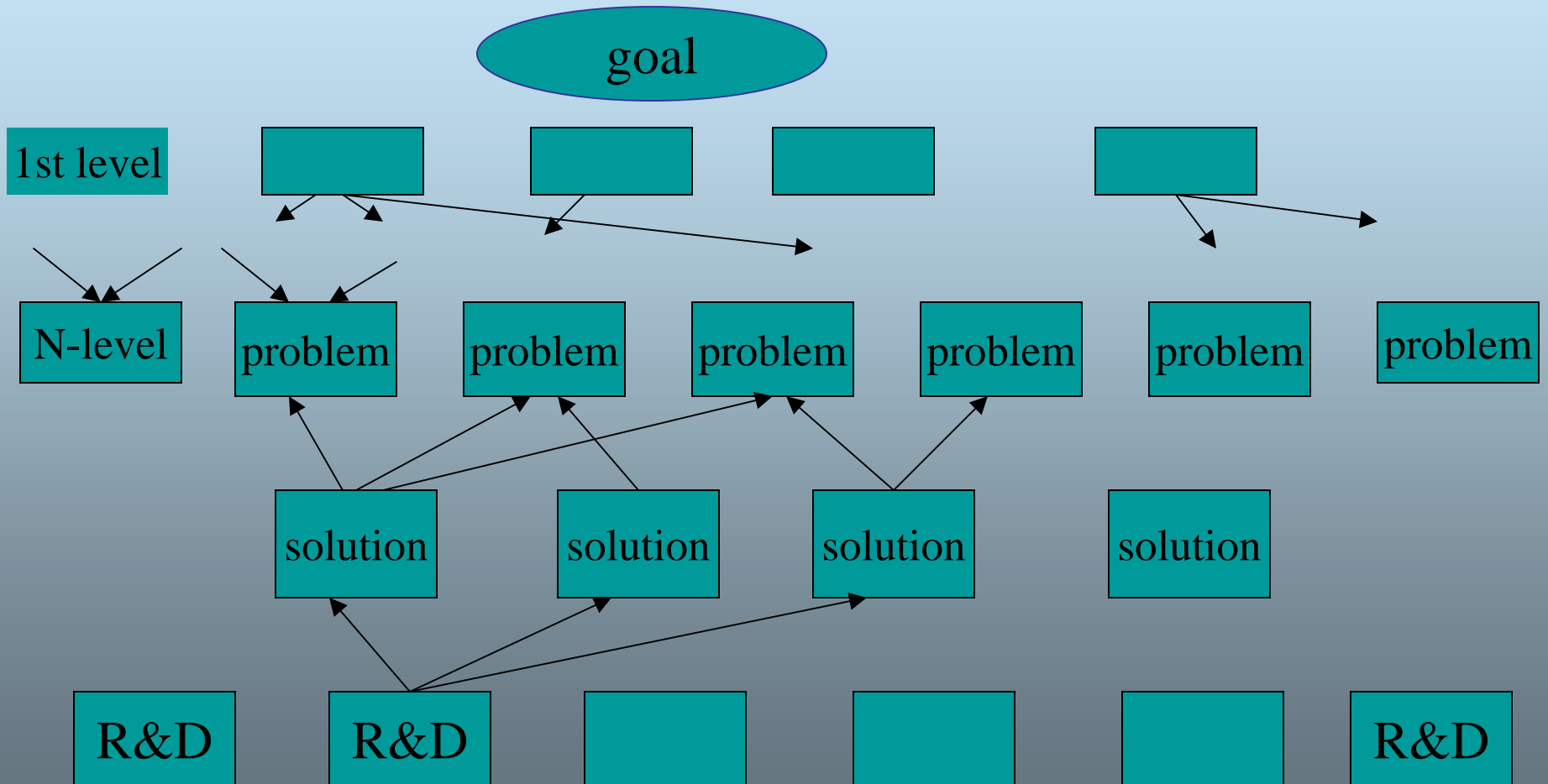
EXPERIENCE: S&T FORESIGHT (1980s)

Normative

- **Threes**
- **Morphological Analyses**
- **Analogies**

EXPERIENCE (1980s)

Threes- Morphological Analyses





Challenges to Experience

Threes- Morphological Analyses

- **Deterministic**
- **Drivers**
- **Cultural issues**
- **Rapidly changing conditions (new threats)**
- **Rapid technological changes, emergency new technologies**
- **Changing system of value**

THREES- MORPHOLOGICAL ANALYSES

- **Participatory approach**
- **Technology watch**
- **Environmental scanning**
- **Scenarios development**

CHALLENGES TO THE EXPERIENCE

Analogies

Chaos and Complexity Theory:

- *Small differences in input might be resulted in huge differences in systems' trajectory*
- *Butterfly effect*
- **Cultural issues**

FOR UNSTABLE SYSTEMS ANALOGIES

Coupling with Long- term Cycles Theory and using historical lessons

- *Social consequences of Internet – social consequences of the printing press (James A. Dewar (1998))***
- *Kondratieff cycles***

EXPERIENCE

Scenarios (1989)

- **Drivers**
- **Changes in impact and interplay of different factors**
- **Weak points and hot spots**
- **Branch point**
- **Strong points and spots of growth**

EXPERIENCE

Scenarios for unstable systems (1995)

- **New role in future exploration**
- **Scenarios put requirements to implementation of other methods and tools**
- **Delphi feed scenarios by information**
- **Coupling of Cross- impact and regression models for quantification**
- **New role of sociological methods and tools**
- **Consequences of different actions' implementation**

Scenarios- key challenges

- **Linearity of thinking and brunch point**
- **Orientation on decision making**
- **New risks and opportunities, emerging challenges**
- **Scenario's quantification**
- **Hot spots**
- **Wild cards**

Wild cards

- **Chaos and Complexity Theory**
 - *Nonlinear*
 - *Cross interactions between different events*
 - *Butterfly effect*
- **Evolutionary Theory**
 - *Destroy the equilibrium*
 - *Rapid changes (not evolutionary)*
 - *Transition to a new order*

Wild cards

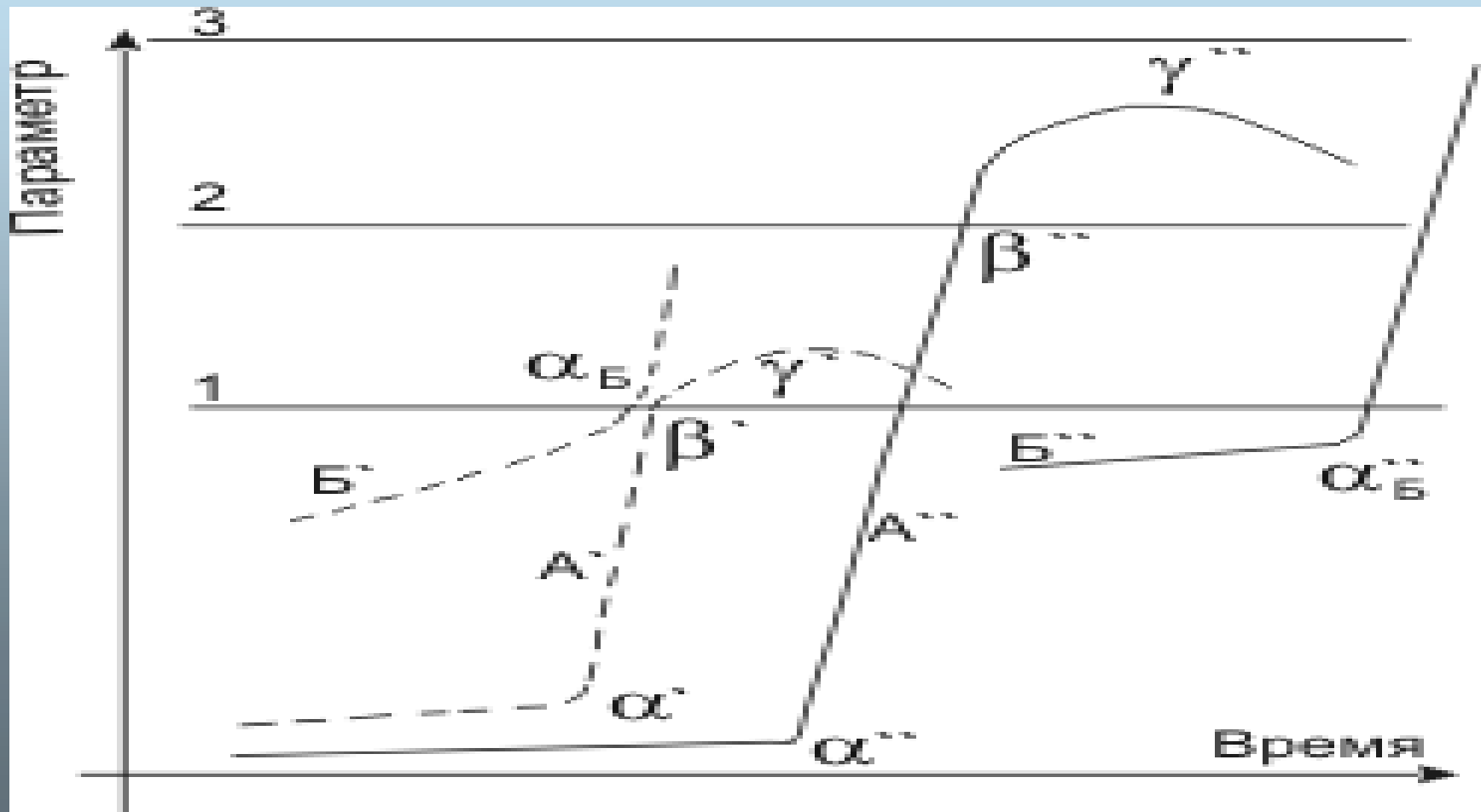
- **Scanning of early warning signals**
- **Modeling (cross-cutting events, indicators)**
- **Coupling modeling & experts**
- **Actions in case of rapid transition**
- **What will be a new order**

EXPERIENCE (1980s) for identified problems

- **TRIZ**
- **Road mapping**
- **Patent information**



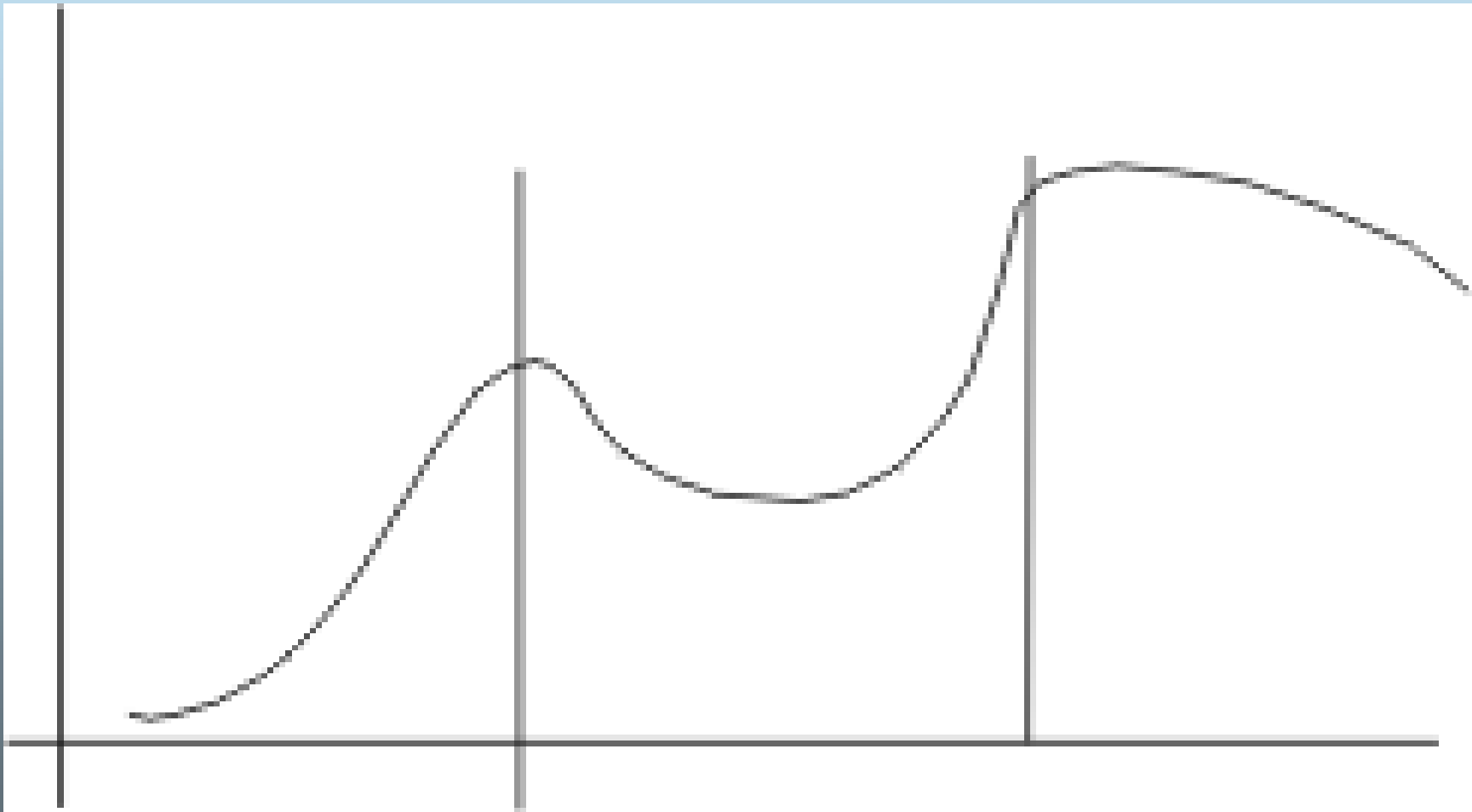
EXPERIENCE (1980s) for identified problems





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EXPERIENCE (1980s) Patent information



Patent information

- **Rapid technological changes**
- **Science- pushed needs**
- **Cultural issues and system of value**



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GUIDANCE

- **Chaos and Complexity**
- **Evolutionary Theory**
- **Cycles**



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Thank you