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# THE SCIENCE AND SYSTEMS ENGINEERING OF LAWS

## RATIONALE AND GOALS

**David G. Schrunk, MD**
**Science of Laws Institute**
**www.scienceoflaws.org**

# DISCUSSION POINTS
## THE SCIENCE AND ENGINEERING OF LAWS

- CREATIVE AND INVESTIGATIVE SCIENCE
- LAWS AND LAWMAKING
- SCIENTIFIC LAWMAKING

# CREATIVE SCIENCE

# CREATIVE SCIENCE

## (ENGINEERING - INVENTION)

Uses Knowledge (K), Tools (T), and Problem-Solving Process (P) to create new tools for problem solution:

$$K + T + P \Rightarrow T_{New}, K_{New}, \text{Problem Solution}$$

(Exponential Rate of Growth)

# CREATIVE SCIENCE
## (PROBLEM-SOLVING PROCESS)

Problem Definition, Analysis

Goal / Purpose

Access Knowledge, Tools, Materials, Methods

Innovation, Expertise, Modeling…

Testing, Validation of new Tool

Results: New Tool, Solution

Record Results

# PALEOLITHIC TO RENAISSANCE

## (Incremental Progress)

1) Usefulness and Variety of Tools Increased (wheel, alloys, mathematical methods, sailboats…)

2) Gradual Increase of Knowledge of Physical World

3) A significant problem with Creative Science was the lack of access to reliable knowledge. No books / records / libraries.

# CREATION OF SCIENTIFIC METHOD

## (Renaissance)

K + T + P => New T (The Scientific Method)

Creative science invented a new tool, the Scientific Method, which was able to generate reliable knowledge of the structure and mechanics of the physical universe. The new access to reliable knowledge greatly enhanced the ability of creative science to develop new tools.

# SCIENTIFIC METHOD

Charles Van Doren, A History of Knowledge, Ballantine Books, New York, 1991, page 185:

*"Of all the kinds of knowledge that the West has given to the world, the most valuable is a method of acquiring new knowledge. Called 'scientific method,' it was invented by a series of European thinkers from about 1550 to 1700."*

# INVESTIGATIVE SCIENCE

The invention of the Scientific Method led to the development of a separate branch of science, termed investigative science or “science,” which focuses on the discovery of new knowledge of the structure and mechanics of the physical universe

# SCIENCE AND ENGINEERING

## Characteristics of Science and Engineering

**Investigative Science:** The compass of investigative science is Truth. To the extent that truth in the physical universe can be defined, science always and reliably seeks truth, accepts truth, and rejects non-truth.

**Science is a "truth machine."**

# SCIENCE AND ENGINEERING

## Characteristics of Science and Engineering

**Creative Science:** No new tool or device of creative science is accepted unless it is superior to the tool it replaces.

**“Change is always characterized by improvement”**

# SCIENCE AND ENGINEERING

## Synergism of Science and Engineering

The expanding and mutually supporting fields of investigative and creative science are the principal, optimistic sources of advancement of the human condition:

- Knowledge and the variety and prowess of tools are growing exponentially
- Current problems being solved by ever-improving means
- Problems of the next higher order of complexity are in the process of being solved

# SCIENCE AND ENGINEERING

## Characteristics, Ethos, Culture

- Scholarship
- Basis in Knowledge
- Quality Standards
- Integrity
- Innovation
- Expertise
- Outcomes-Driven (i.e., Improvement, Success)

# LAWS AND LAWMAKING

# GOVERNMENT AND LAWS

**Government:** The institution that is necessary for the organization, stability and functioning of a society

**Laws:** The *means*, or tools, by which the *ends* of government are achieved.

# GOVERNMENT AND LAWS

**Purpose / Obligation of Government**
**("Liberal Government" "Democracy"):**

**Secure** the Rights and Liberty of the People
Human Rights, Living Standards, Quality of Life

**Therefore, Purpose of Laws:**

**Solve** the Societal **Problems** that Degrade or Threaten to Degrade the Rights and Liberty of the People

# USEFULNESS OF LAWS

- Create Stable Framework of Government
  - Direct, control human behavior
  - Maintain order, resolve disputes
  - Establish, define rights, tasks, responsibilities, prohibitions

# LAWMAKING AROUND CAMPFIRES

(Language Development 150-200,000 BC)

<u>Traditional Method of Lawmaking</u> Established

Leaders present, discuss ideas for rules (laws)
Debate, deliberate, exchange…
Approve new law
New law enforced

**Idea => Consensus opinion => Approve => Enforce**

# TRADITIONAL METHOD OF LAWMAKING UNCHANGED TO PRESENT TIME

IDEA → DEBATE → LAW

# PROBLEM WITH THE TRADITIONAL METHOD OF LAWMAKING

# SUCCESS

50 U.S. State Governments

Annually enact **10,000's** (+) Bills into Legislative Statutes (!)

# FAILURE

50 U.S. State Governments

Despite increasing numbers of laws, problems of crime,

poverty, illiteracy, pollution, homelessness… persist

# RESEARCH PROJECT

Search for Cause of Failure of Laws to Satisfy Purpose of Government

# RESEARCH PROJECT

## MATERIALS

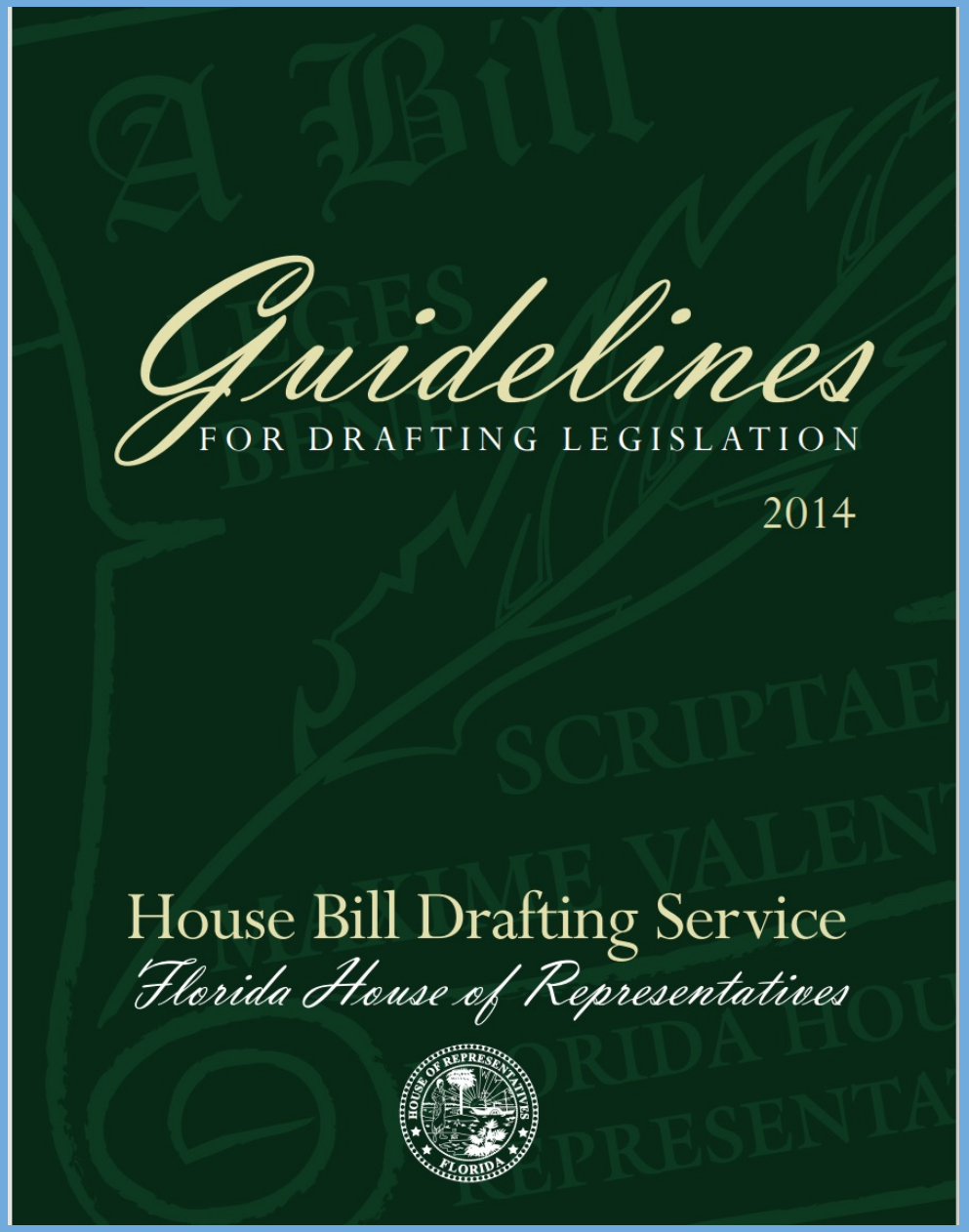
30 U.S. State Governments

Bill Design Manuals

# TYPICAL

# BILL DESIGN

# MANUAL



# Review Bill Design Manuals

## For Content of Problem-Solving Elements

- Problem Definition, Analysis, Prioritization
- Purpose Statement, Method of Sanction Selection
- Cost and Risk Analyses
- Citation of References, Data Bases
- Follow up Evaluation
- Signature of Bill Designer

# RESEARCH FINDINGS

# Findings Bill Design Manuals

REQUIRED PROBLEM-SOLVING ELEMENTS:

- Problem definition*, analysis: **None**
- Problem prioritization: **None**
- Purpose statement: **None***
- Sanction rationale: **None**

# Findings Bill Design Manuals

REQUIRED PROBLEM-SOLVING ELEMENTS:

- Cost analysis: **Incomplete***
- Risk analysis: **None***
- Basis in Knowledge: **None**
- Follow up evaluation: **None**
- Signature of Designer: **None**

# Law Design Process
# U. S. State Government (Manuals)

1) Not a problem solving process (!)
2) Produces laws with multiple defects, omissions
3) Adds to number, complexity of body of laws
4) Increases potential for ineffectiveness, chaos, and arbitrary enforcement of laws

# **RESEARCH CONCLUSION** (IRONY)

Legislatures attempt to solve societal problems with a law-design process that does not have problem solution as its objective

# RESEARCH CONCLUSION

1) The continued production of defective and non-performing laws is unacceptable for any government that is dedicated to the well-being of the people

2) A quality transformation of the lawmaking process is needed

# SOLUTION TO THE NEED FOR A COMPETENT PROBLEM–SOLVING LAWMAKING PROCESS?

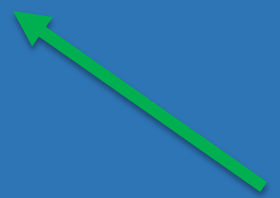
# SOLUTION

## SCIENTIFIC LAWMAKING

## EXPAND SCIENCE TO ENCOMPASS LAWS AND LAWMAKING

# SCIENCE / ENGINEERING

**NUCLEAR SCIENCE GENETICS**
**ROCKETS PHARMACOLOGY**
**AEROSPACE COMPUTERS**
**ELECTRONICS…**



**LAWS**
**LAWMAKING**

# THE SCIENCE AND SYSTEMS ENGINEERING OF LAWS

# Scientific Knowledge of Laws

## Science of Laws Institute

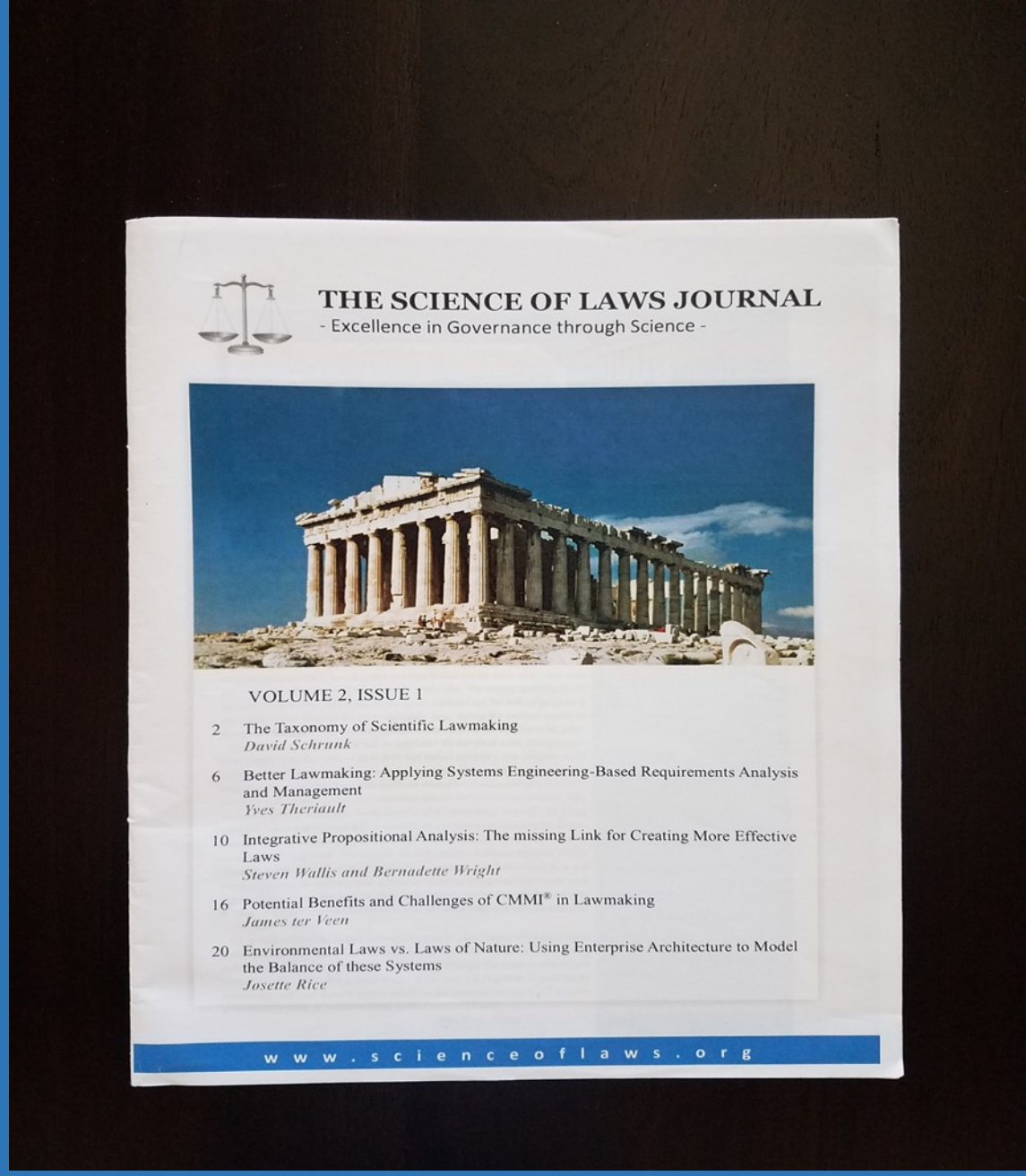
Founded 1995

# Science of Laws Institute

www.scienceoflaws.org

- Introduces the Science and Engineering of Laws Concept
- Search Engine for Knowledge of Laws and Lawmaking
- Science of Laws Journal

# The Science of Laws Journal



# New Approach to Law Creation and Validation

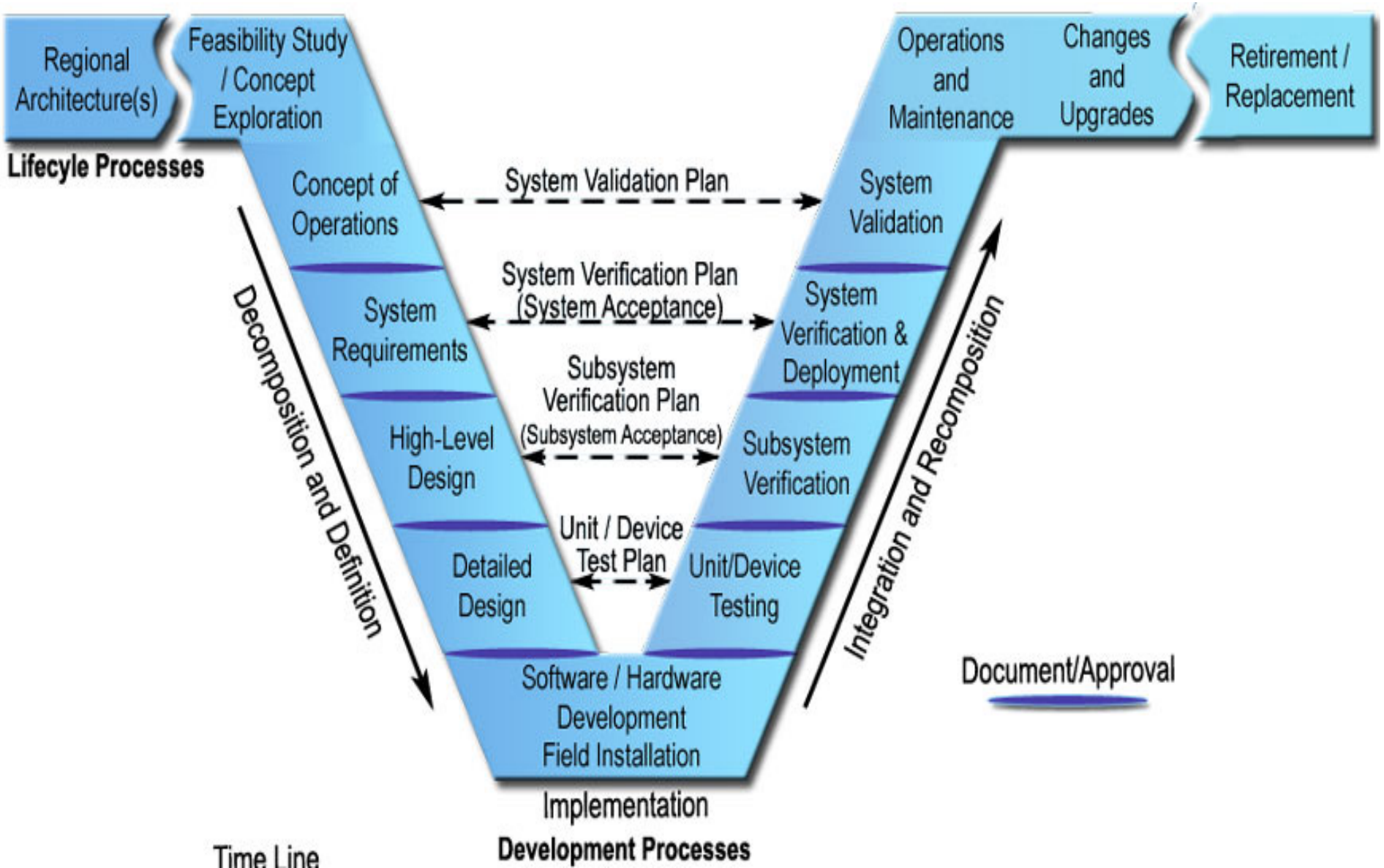
## Systems Engineering

Eminently Suited to the Creation and Validation of Laws that Satisfy the Purpose of Government

# Systems Engineering and Lawmaking Working Group (SELAW)

***Formed to explore the application of SE standards and methods to lawmaking***

# THE FUTURE OF LAWMAKING



# SELAW

- Organized May 2022
- Monthly meetings
- Research divided into eight subgroups
- Report findings in science / engineering literature

# SELAW RESEARCH SUBGROUP #1

- Research and document flaws and omissions of traditional lawmaking
  - Work ongoing

# SELAW RESEARCH SUBGROUP #2

- Establish IEEE Std 15288 steps as the framework for law creation and validation

  - IEEE Std 15288: ISO/IEC/IEEE International Standard – Systems and Software engineering -- System life cycle processes

  - Initial flow chart developed

# IEEE Std 15288: 2015 Systems and Software Engineering

1. **Business or Mission Analysis** Process
2. **Stakeholder Needs and Requirements Definition** Process
3. **System Requirements Definition** Process
4. **Architectural Definition** Process
5. **Design Definition** Process
6. **System Analysis** Process
7. **Implementation** Process
8. **Integration** Process
9. **Verification** Process
10. **Transition** Process
11. **Validation** Process
12. **Operation** Process
13. **Maintenance** Process
14. **Disposal** Process

# SELAW RESEARCH SUBGROUP #3

- **Modeling** of law-sanctions (fine, jail, licensure, tariff, subsidy, …)
  - Enable selection of most appropriate sanction for problem solution
  - Study initiated

# SELAW RESEARCH SUBGROUP #4

Cost modeling of laws

1) Research and development
2) Legislative process
3) Promulgation
4) Direct drain from treasury
5) Enforcement
6) Compliance
7) Courts
8) Validation

9) Opportunity costs (sum of costs 1-8)

# SELAW RESEARCH SUBGROUP #5

- Develop risk models for laws
  (A new field of law research)
  - Research initiated
    - Risk to Human Rights (Unconstitutional, Intrusive…)
    - Risk to Living Standards (Unfunded mandates…)
    - Risk to Quality of Life (Crime, Pollution… E-I Statement)

# SELAW RESEARCH SUBGROUP #6a

- Validation of existing laws – Structure

  (Content: Problem definition, purpose, citations…)

  - Research initiated
  - Identify and record structural flaws and omissions
  - Defective laws reported to legislature for amendment or repeal
  - Methods / findings reported in scientific literature

# SELAW RESEARCH SUBGROUP #6b

- Validation of existing laws – Mechanics (Outcome)
  - Benefit / Cost-Burdens Outcome of laws
  - Report methods and findings of success / failure of laws
    - To Scientific literature for future reference
    - To Legislature
      - Failed laws subject to amendment or repeal
  - Research initiated

# SELAW RESEARCH SUBGROUP #6

- Recommend Repeal or Amendment of Laws:
  - No Problem Definition
  - Problem no longer exists
  - No stated purpose in terms of outcome
  - Duplicates other laws
  - Interferes with other laws
  - Sum of costs and other burdens > or = benefit
  - No basis in knowledge
  - No QA review within specified period (automatic repeal)

# SELAW RESEARCH SUBGROUP #7

- Develop credentials for Law Engineers and Scientists
  - Research planned
  - Publish results (e.g., in SE literature…)

# SELAW RESEARCH SUBGROUP #8

- SE Law Creation and Validation Manual
  - Publish at future date
  - Based on summary of Subgroup research and findings

# SUBGROUP REPORTS

- Findings Published in the **Scientific Literature**
- Ongoing Accumulation of Law-related Knowledge
  - Structure and Mechanics of Laws
    - e.g., Impact on Human Rights, Living Standards, Quality of Life
  - Advances in Law-Creation Standards, Methodologies…*

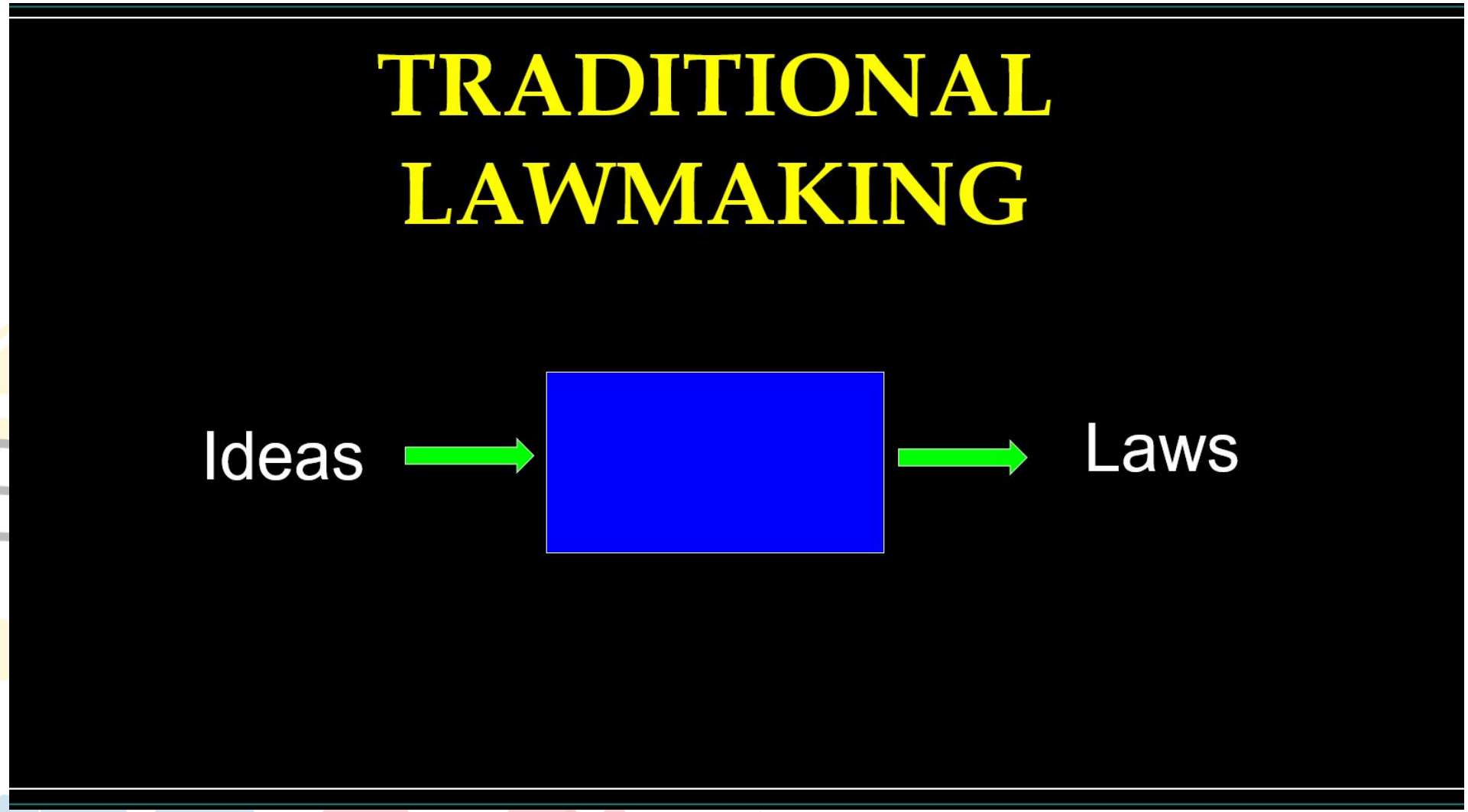
# SIGNIFICANCE OF LAW-SCIENCE

## Basis for Outcomes-Directed Lawmaking

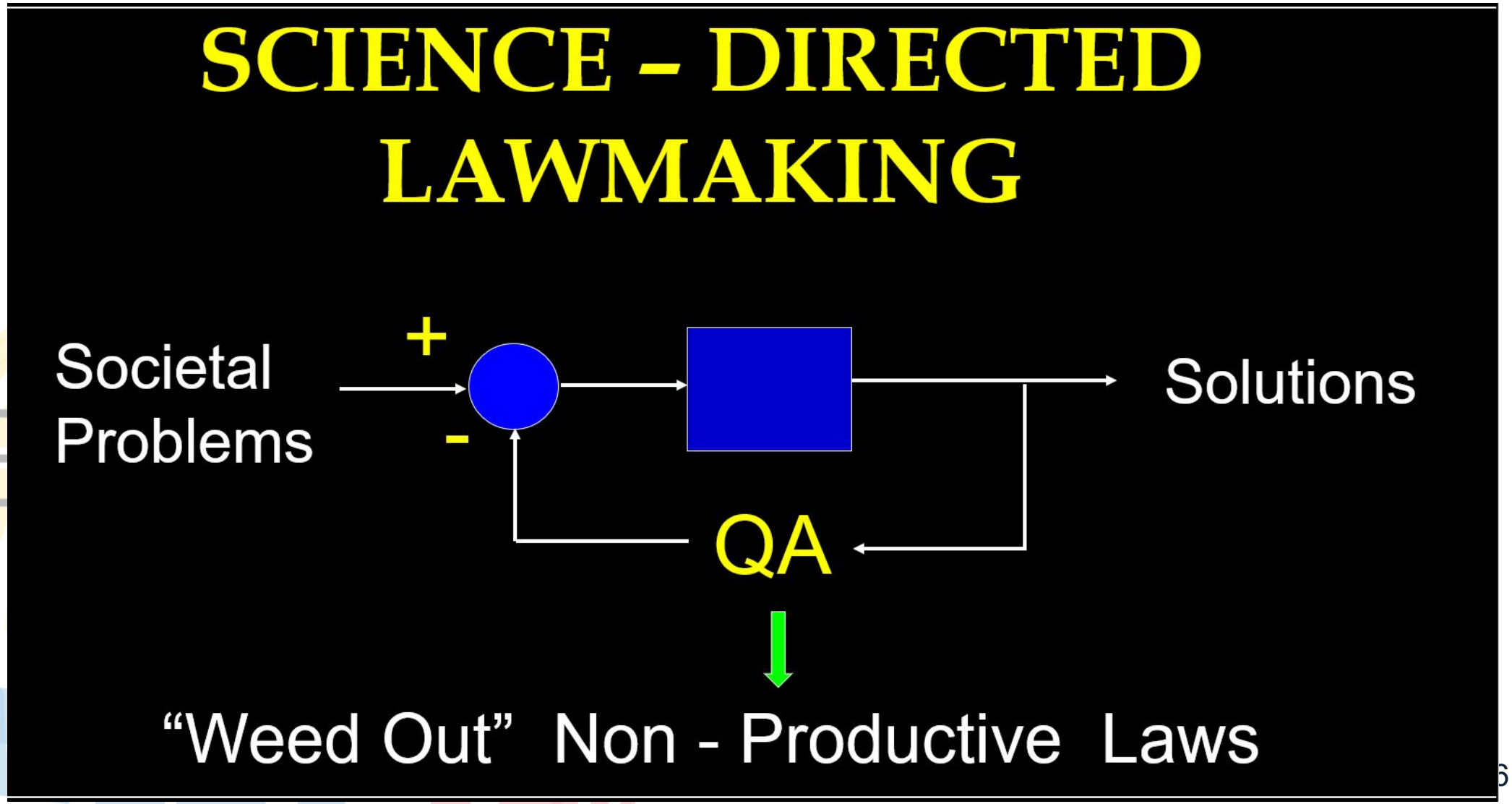
| ← LAW CAUSATION → | | |
|---|---|---|
| Limitations, Abuse | HUMAN RIGHTS | Secure |
| Poverty, Privation<br>Unstable Currency | LIVING STANDARDS | Affluence<br>Stable Currency |
| War<br>Crime<br>Pollution<br>Resource Mismanagement | QUALITY OF LIFE | Peace<br>Security<br>Clean Environment<br>Competent Management |

# SUMMARY

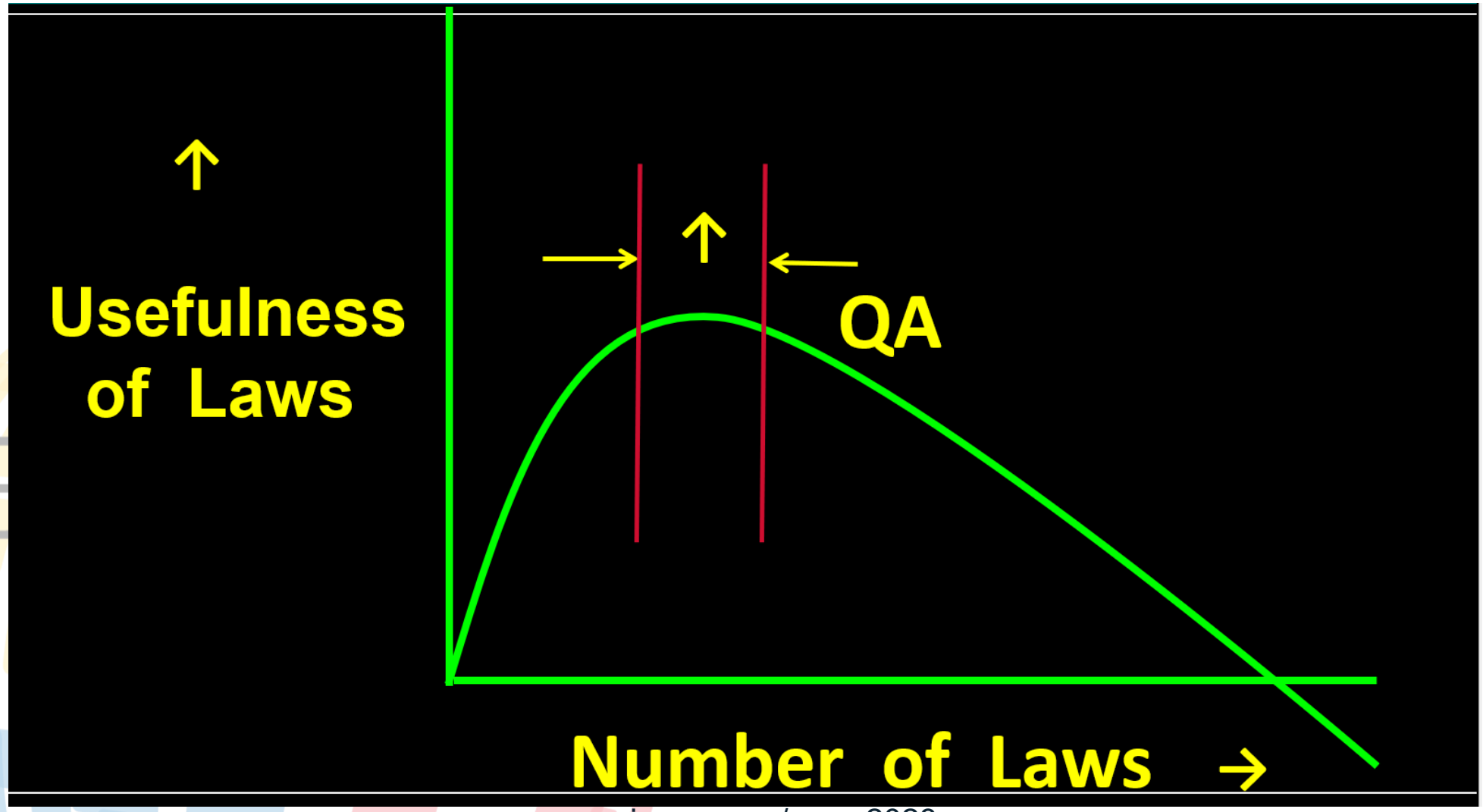
# PRESENT PARADIGM: MAKE LAWS



# FUTURE: ELEGANT SOLUTIONS



# FUTURE: OPTIMUM PERFORMANCE

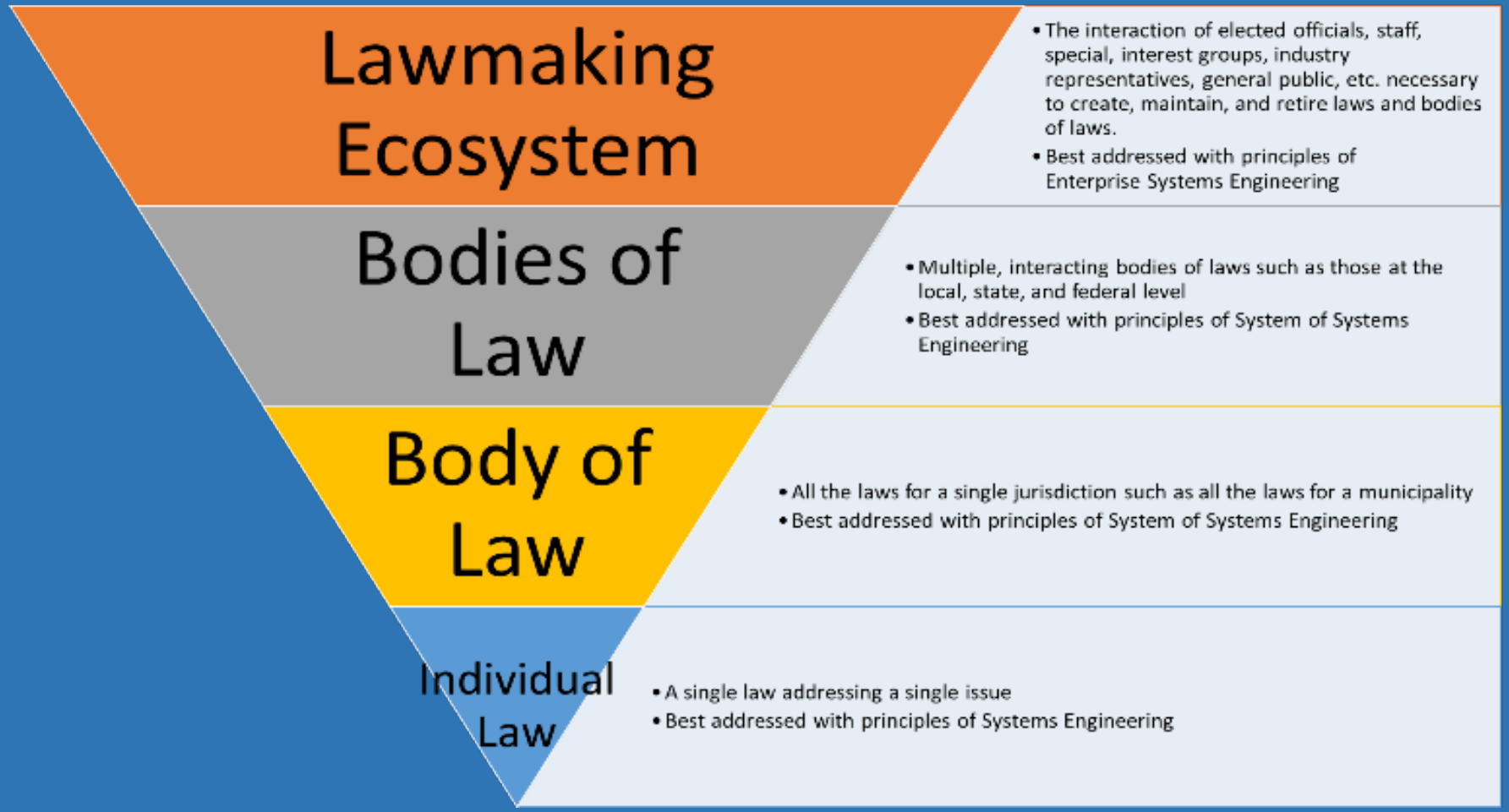


# CONCLUSION

# The Science and Systems Engineering of Laws

- An emerging new field of science
- Transform lawmaking into a knowledge industry
- Create “elegant,” efficacious law-solutions to societal problems
- Enable governments to create a rule of law that optimally satisfies the purpose of government

# THANK YOU




## Levels of Complexity within Law and Lawmaking

The systems engineering of laws and lawmaking will constitute an ecosystem that enables the creation, validation, maintenance, and retirement of laws and bodies of laws.

# SCIENCE AND ENGINEERING

## Synergism of Science and Engineering

From WSJ, p. A19, April 11, 2023, by Michael Milken, Chairman of Milken Institute (on advances of medicine in the past 50 years):

*"Science now allows us to repond to health crises with antibiotics, polio vaccines, statins, genome sequencing, immunotherapies, monoclonal antibibodies, anti-retroviral cocktails, robotic surgeries, advanced nutrition, powerful new diagnostic scans, focused ultrasound, artificial intelligence, Crispr gene editing and mRNA vaccines."*

# SELAW Subgroups

1. Document the **defects and omissions** in traditional lawmaking

2. Derive **lawmaking standards** based on systems engineering principles (e.g., the IEEE-15288)

3. Create **models of sanctions** (fine, tax, tariff, subsidy…)

4. Create a **comprehensive cost model** for laws

# SELAW Subgroups

5. Create of a **risk-assessment model** for laws

6. Create **standards for the periodic follow-up** evaluation and validation of existing laws

7. Establish **credentials for designers** (drafters) of law-design

8. Create and **publish** an SE law-design manual