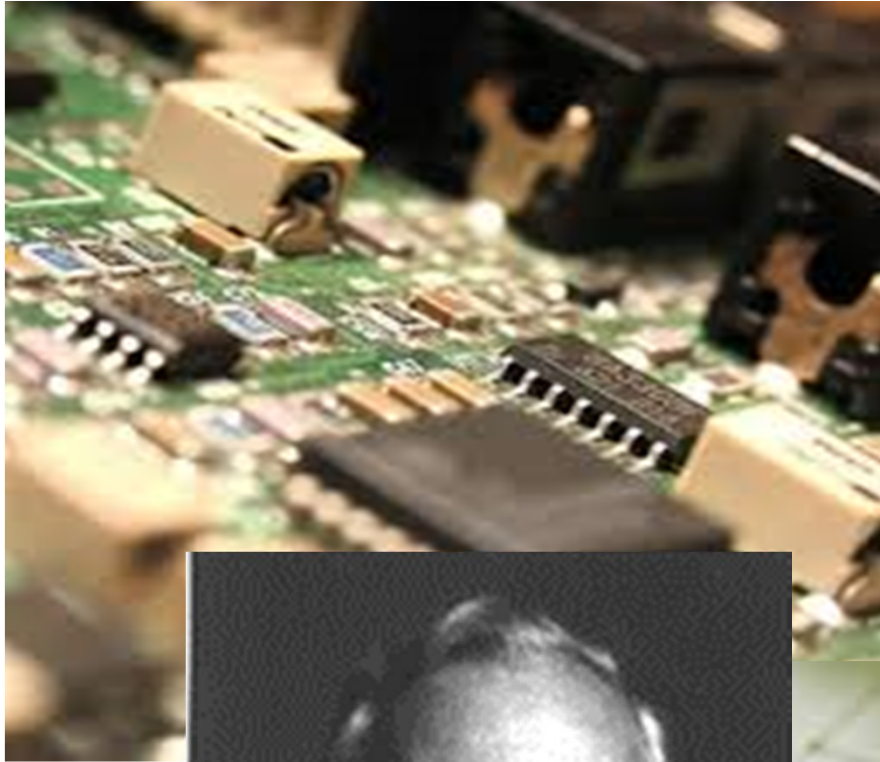Systems Thinker:
Jay Wright Forrester

Presented by:

Mahsa H. Sadi

Department of Computer Science

- Electrical Engineer
- Systems scientist
    - Hard systems view point in Systems Thinking

- Research assistant in MIT from 1939; working on feedback control systems

- Developing control systems for radar antennas and guns during world-war II

- After world-war II, he began to **build aircraft flight simulators** for the Air Force

- Forrester continued research in Electrical Engineering until 1956.

- Then he moved to MIT Sloan School of Management, where he is currently a professor.

- Born in 1918. (He is 95 years old)

\- He brought his background in electrical engineering and his hard systems view point to the field of management and human systems.

- Founder of system dynamics
  - Human systems need flight simulators
    - Human systems can be predicted and controlled
  - Defining mathematical relationships between elements of human systems
  - Simulating the interaction of objects in dynamic systems
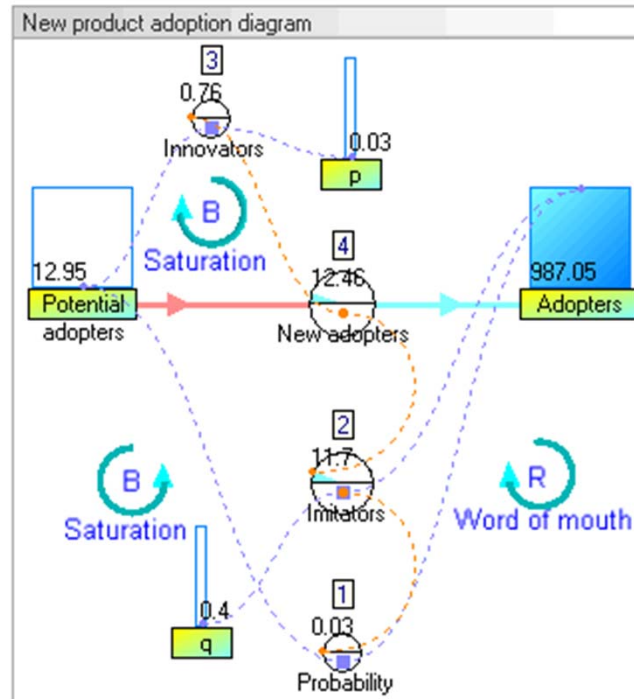
- Applying feedback control system ideas to management
  - Positive feedbacks, negative feedbacks
  - Stocks (Capacitors), and flows (electrical currents)

Donella Meadow

Jay Forrester

John Sterman

Dennis Meadow

Alinaghi Mashayekhi

Jay W. Forrester

Industrial Dynamics

SYS

WORLD
DYNAMICS

Jay W. Forrester

BUSINESS
DYNAMICS

John D. Sterman

*Systems
Thinking and
Modeling for a
Complex World*

Jay W. Forrester

Urban Dynamics

Foreword by John F. Collins

SYSTEM DYNAMICS SERIES

PEGASUS

World Dynamics

Birth rate normal BRN BRN1, SWT1

Birth-rate-from-material multiplier

BRMM / BRMMT 3

BR Birth rate 2

Birth-rate-from-food multiplier

BRFM / BRFMT 17

Birth-rate-from-pollution multiplier

BRPM / BRPMT 18

Food ratio

FR 19

Food ratio

BRCM / BRCMT 16

Birth-rate-from-crowding multiplier

P Population 1

CR 15

Crowding ratio

Land area LA

Death-rate-from-crowding multiplier

Crowding ratio

Food-from-crowding multiplier

FCM / FCMT 20

FN Food normal

FC FC1, SWT7 Food coefficient

FPCI / FPCIT 21

Food potential from capital investment

Food-from-pollution multiplier

FPM / FPMT 28

DR Death rate 10

DRCM / DRCMT 14

PDN Population density normal

Pollution ratio

DRN DRN1, SWT3 Death rate normal

DRFM / DRFMT 13

Death-rate-from-food multiplier

DRPM / DRPMT 12

Death-rate-from-pollution multiplier

Population

Pollution normal POLN POLN1, SWT6

POLG Pollution generation 31

POLCM / POLCMT 32

Pollution-from-capital multiplier

Pollution ratio

DRMM / DRMMT 11

Death-rate-from-material multiplier

CIM / CIMT 26

Capital-investment multiplier

CIG Capital-investment generation 25

CIGN CIGN1, SWT4 Capital-investment generation normal

CIRA 22

Capital-investment ratio in agriculture

POL Pollution 30

POLS Pollution standard

POLR 29

Natural-resource usage normal NRUN NRUN1, SWT2

CI Capital investment 24

CIR 23

Quality-of-life standard QLS

POLA Pollution absorption 33

Pollution-absorption time

POLAT / POLATT 34

NRUR Natural-resource-usage rate 9

Capital-investment ratio

Capital-investment-in-agriculture fraction normal CIAFN

Quality of life QL 37

Quality of life from pollution

QLP / QLPT 41

CID Capital-investment discard 27

Natural resources, initial NRI

Natural-resource-extraction multiplier

Capital-investment-in-agriculture-fraction adjustment time CIAFT

QLM / QLMT 38

Quality of life from material

QLC / QLCT 39

Quality of life from crowding

NR Natural resources 8

CIDN CIDN1, SWT5 Capital-investment discard normal

ECIR 5

CIAF Capital-investment in-agriculture fraction 35

NRMM / NRMMT 42

Natural-resource-from-material multiplier

NRFR 7

NREM / NREMT 6

MSL 4

Natural-resources-fraction remaining

Effective-capital-investment ratio

CIQR / CIQRT 43

QLF / QLFT 40

CFIFR / CFIFRT 36

Effective-capital-investment ratio normal ECIRN

Material standard of living

Capital-investment-from-quality ratio

Quality of life from food

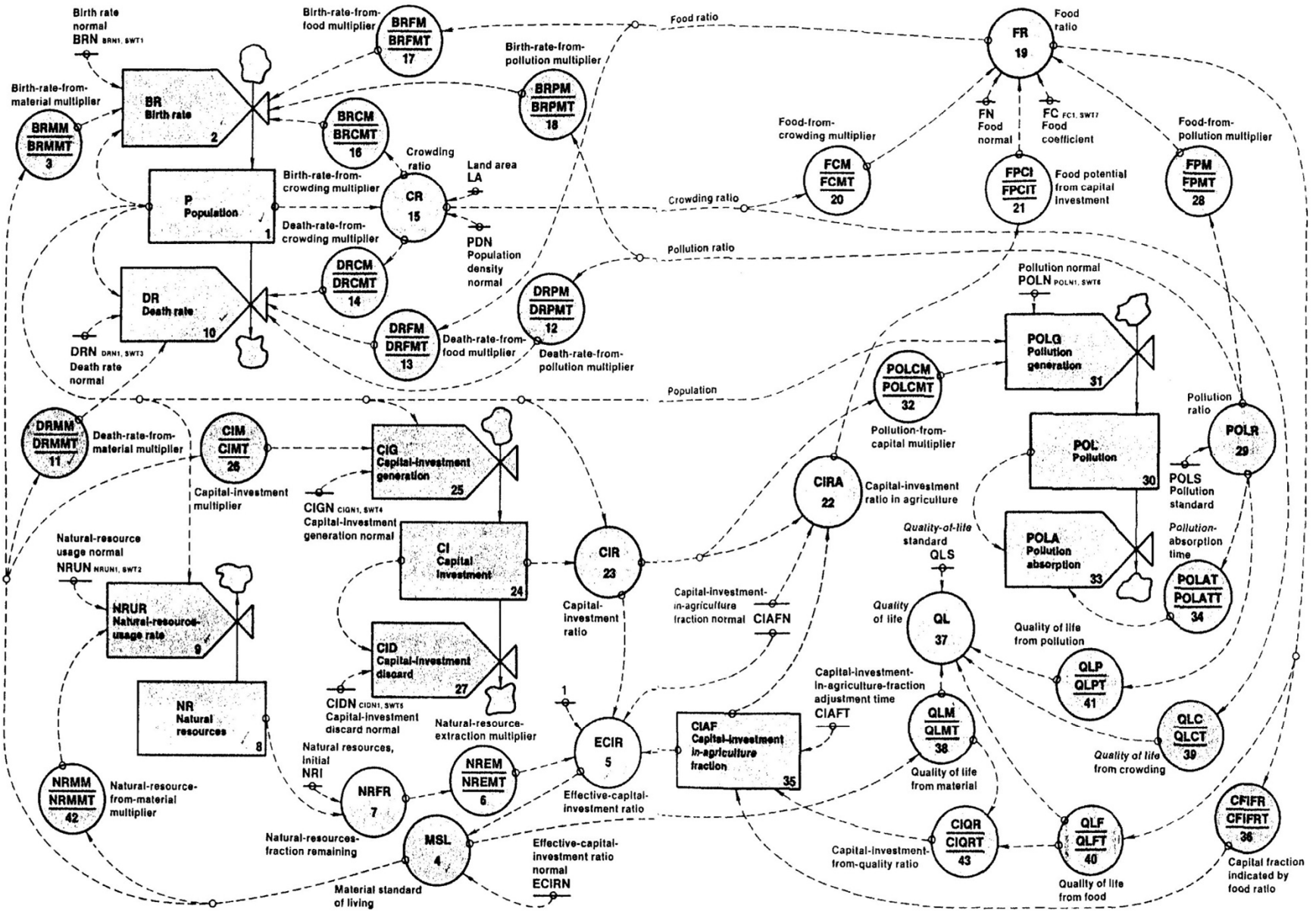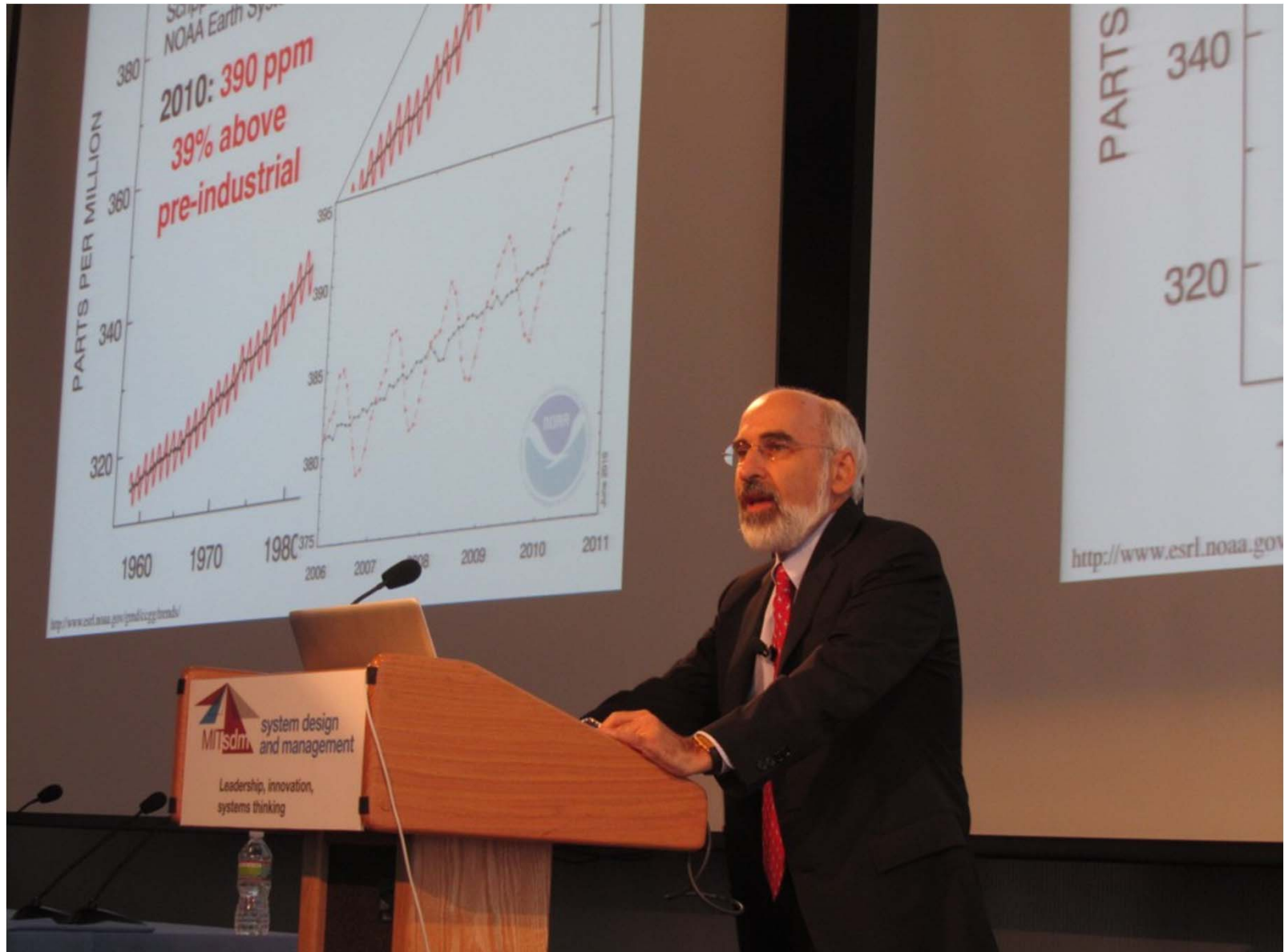Capital fraction indicated by food ratio

Figure 2-1 Complete diagram of the world model interrelating the five level variables — population, natural resources, capital investment, capital-investment-in-agriculture fraction, and pollution.

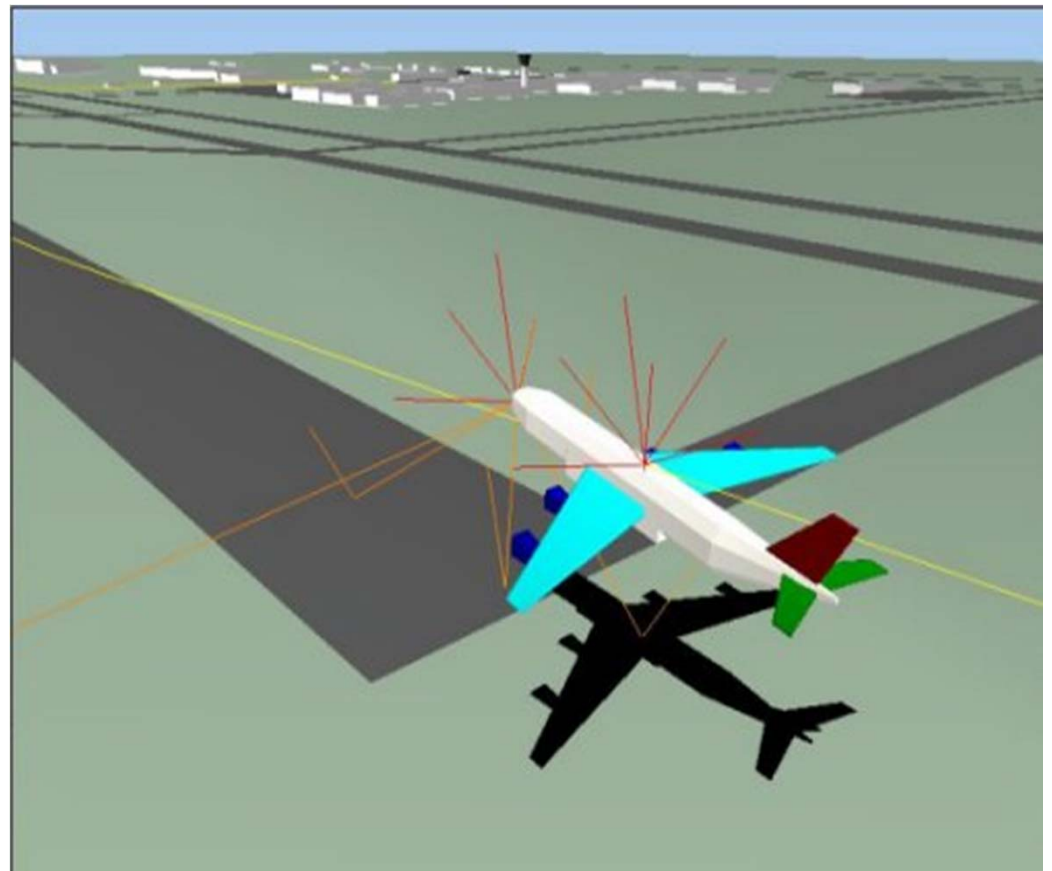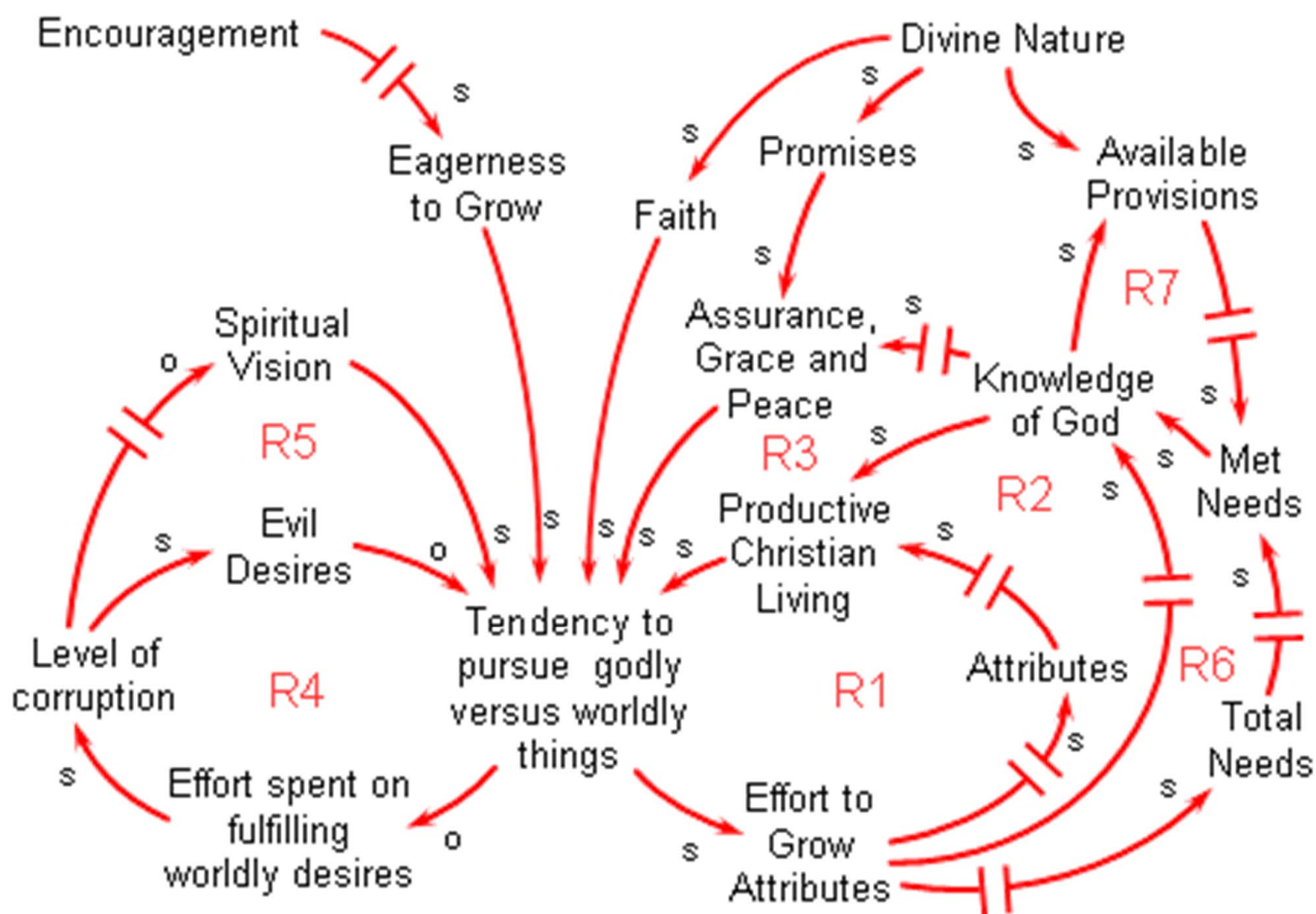- System Dynamics, Climate Change and Intergovernmental Panel on Climate Change

System Dynamics and Simulation

- Well-Adopted in hard systems areas:

- Energy systems
- Economics
- Supply chains

- Weak in Soft systems

- Unpredictable
- Complex and complicated

How human systems can be solve by differential equations?

Even simulation is impossible

THANK YOU