

A Vision for IT-Based Cottage Industry for Developing Countries

In collaboration with

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OBJECTIVE

- MITIGATE THE MALTHUSIAN CATASTROPHE
- WHAT DOES THIS MEAN?
- DESIGN—DEVELOP—MAINTAIN—
USE—REUSE—RENEW PRODUCTS,
SYSTEMS AND SERVICES

METHODS OF DEVELOPMENT

USE, SAVE, RENEW CRITICAL PHYSICAL
RESOURCES (P)—
LESS EXPENSIVE AND LESS COST
LAW OF DIMINISHING RETURNS—
A. MARSHALL

METHODS OF DEVELOPMENT— CONTD.

- USE LESS MANUAL EFFORT (M)
- USE MORE TECHNOLOGY, MORE AUTOMATION
- REASON: WE DO NOT LIKE MANUAL ACTIVITIES
- LAW OF CONVINIENCE, COMFORT AND ENJOYMENT

METHODS OF DEVELOPMENT— CONTD.

- USE MORE INTELLECTUAL EFFORT (I)
- MORE BRAIN POWER
- MORE KNOWLEDGE AND BETTER TECHNOLOGY
- LAW OF INCREASING RETURNS,
ARTHUR AND ROMER

METHODS OF DEVELOPMENT CONTD.

- BALANCE AND OPTIMIZE THESE I, M,P RESOURCES TO SUSTAIN HUMANITY IN THE FUTURE
- IMPROVE THE SUSTAINABILITY INDEX

METHODS OF DEVELOPMENT CONTD.

- DAVID RICARDO'S LAW OF COMPARATIVE ADVANTAGE
- USE EXCESS RESOURCES (I) AND (M) TO COMPENSATE FOR SCARCE AND NONRENEWABLE PHYSICAL RESOURCES (P)
- THIS WILL SAVE THE PHYSICAL RESOURCES (P), AND REDUCE OUR MANUAL ACTIVITY.

METHODS OF DEVELOPMENT CONTD.

- USE INFORMATION, AND
COMMUNICATION TECHNOLOGY (ICT)
AS COTTAGE (HOME BASED)
INDUSTRY

MILTON FRIEDMAN'S CONCEPTUAL FRAMEWORK

- HYPOTHESIS→EMPIRICAL MODEL
→DATA→FACTS→THEORY→OPTIMIZE
→USE, REUSE, RENEW

GENETIC ALGORITHMS, INCREMENTAL AND LEAP- FROGGING MODELS

- GENETIC ALGORITHMS
- MATURITY MODELS
- CONTINUOUS PROCESS
IMPROVEMENT (CMM) METHODS,
NEWTON RAPHSON, RECURSIVE
PROCESSES, DIFFERENCE
EQUATIONS, GENERATING
FUNCTIONS.

LEAP FROGGING AND RANDOMNESS

- RALPH GOMORY
- SPIRAL (INCREMENTAL
IMPROVEMENT) AND STAIRCASE
(LEAP FROGGING) METHODS

THEORY OF EVOLUTION-- DARWIN

- FUNDAMENTAL LAW OF BIOLOGICAL ORGANISMS= SURVIVAL
- SURVIVAL PRINCIPLES:
- ADAPTATION
- MULTIPLICATION
- SPECIATION

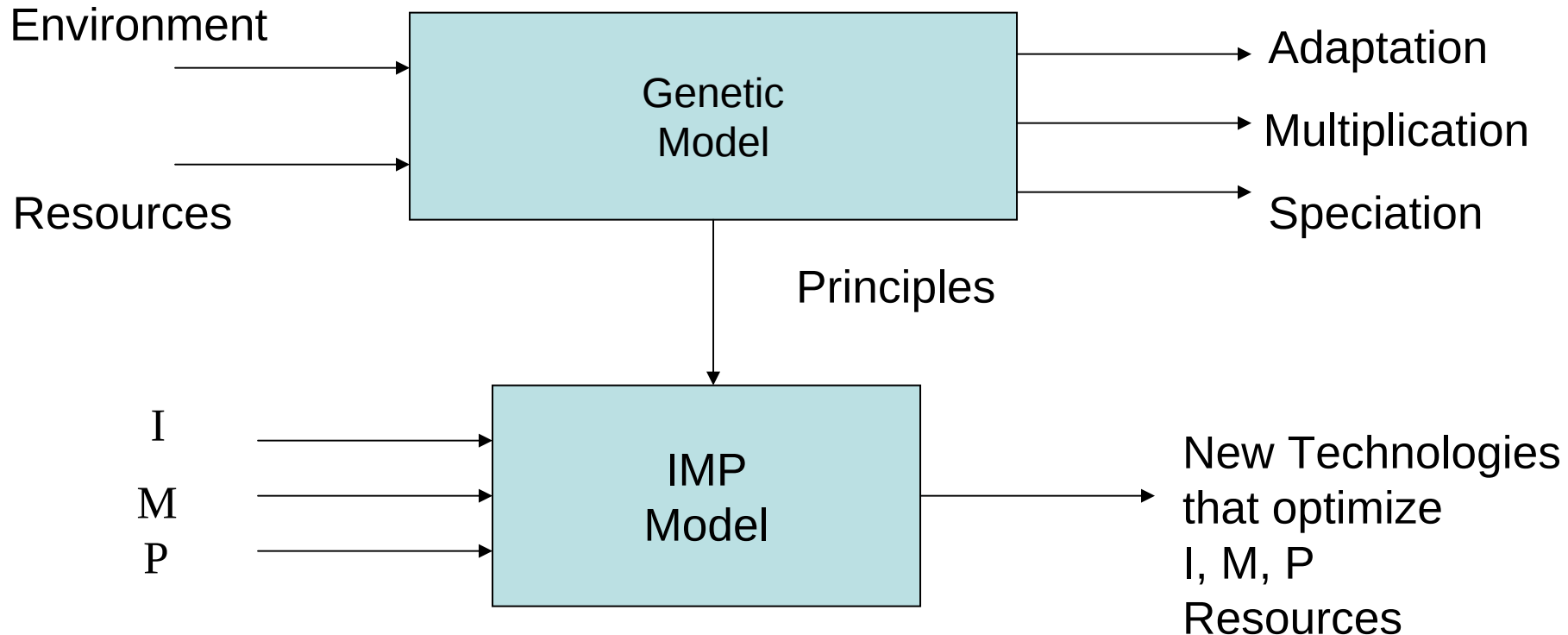
SPECIATION

- CREATE MUTATIONS BY INTRODUCING RANDOMNESS DURING DUPLICATION AND MULTIPLICATION PROCESS
- SELECTION OF THE FITTEST—NATURAL SELECTION= SELECTING BETTER GENERATION
- THIS IS EQUIVALENT TO REDUCING ENTROPY AND UNSTRUCTUREDNESS =LESS COMPLEXITY

COMPOUND MODEL

- SUPERIMPOSE BIOLOGICAL
EVOLUTIONARY MODEL ON THE IMP
RESOURCE MODEL

Genetic & IMP Hybrid System



The Objective of This Presentation

- We all recognize the serious challenges in the world today
 - Life support resources (air, water, environment) being poisoned
 - Natural resources (minerals, fossil fuels) fast depleting
- In this presentation, we propose a partial, not a total solution
- We will continue to need big industries, large-scale mass-production factories
- We must solve the problem comprehensively; else, all of us will be in peril
- A big part of the equation had been missing so far; to-date, a huge population of society had never been engaged
- The ignored masses want to contribute; until now, no easy mechanisms were available
- The Internet is drawing these people from every corner of the world and providing them an opportunity to participate
- The cottage industry model is ideally suited to bring this grand experiment to fruition – (1) reduces demand on natural resources, (2) fosters collaboration between people, (3) promotes harmony

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- The cottage industry model is ideally suited to bring this grand experiment to fruition – (1) reduces demand on natural resources, (2) fosters collaboration between people, (3) promotes harmony and education.

Serious Challenges

- Symptoms of Malthusian catastrophe
- Life support resources (air, water, environment) being poisoned
- Natural resources (minerals, fossil fuels) fast depleting
- Arable land diminishing, atmosphere and oceans polluted, global warming
- Wanton wastage, no care for conservation or harmony with Nature
- Uncontrolled population growth
- Human longevity increasing, Dowling (Harvard) predicts 118 year average life expectancy by 2050, up from 78 in the US today
- Age related diseases (Alzheimer's) on the rise, intellectual depreciation and people need care longer
- Knowledge doubling every 3-5 years: Technology doubling every 18 months; Moore's Law: Technology influence grows at the rate $=O(N^2)$ —Metcalf's Law
- Education offering and growth, in contrast, is at a snail's pace; inverse of the Moore's Law: gap between technology advance and education is widening exponentially.
- As a result, we are becoming more and more dependent on computers and robots (Bill Joy) – human beings are depreciated & may be taken over by robots

Serious Challenges (Cont'd)

- Educational concerns
- No emphasis on saving or improving earth environment, ethics, and ecology in our courses or programs
- No emphasis on conservation of energy, non-renewable resources, alternative energy creation
- Emphasis on narrow specializations, as opposed to broad trans-disciplinary aspects – as technology advances, people cannot migrate rapidly and are quickly obsoleted

Population Composition of Developing Countries

- Rural & Agricultural $\approx$ 80%
- Educated (High school $\approx$ 17%
and more)
- Rich & Affluent $\approx$ 3%
- So far, the educated population have been creating wealth & growth
- Rural & Agricultural population is neglected

Importing Yesterday's Cottage Industry to the Future

- Information communication technology based cottage industry (ICT/CI) represents a reasonable partial solution
- This is not a total solution, we still need large-scale, mass-production factories and industries
- Exploit Peter Drucker's theory of "knowledge worker" – cast high tech knowledge industry in the form of cottage industry
- How does the cottage industry model fit into the high tech world?
- Review essential characteristics of the cottage industry
 - Small group of people working from home, collaborating on an activity
 - Requires few resources and infrastructure, employ easily available tools -- laptop, phone, Internet, etc—already available.
 - Craftsmen, tool makers, textile worker, carpet makers, farmers working during long winter months at their own pace
 - Part-time and telecommuting professionals – travel to distant workplace not mandatory – minimum commute and create little pollution
 - No heavy, stressful manual work
 - Ideally suited for women, older people, home makers, and families
 - Evolve into knowledge workers in the knowledge age

Cottage Industry for the Future

- Cottage industry will help keep Internet relevant
- In turn, Internet will enable cottage industry thrive
- Ideal for developing countries with highly educated, large population but with poor transportation infrastructure and energy to waste
- Cottage industry likely to proliferate, especially in China, India, Brazil
- Quality of life likely to be very high and harmonious with Nature
- Because of small groups, cottage industry can create one-of-a-kind systems (small-scale) and innovative designs – The Amazon.com model thrives on offering unique, rare and personalized products/artifacts .

Why Cottage Industry?

- Review current state of the world
 - Resource depletion & environmental degradation (Malthusian catastrophe)
 - Global warming – Al Gore’s, “An Inconvenient Truth”
 - Increasing population and law of decreasing returns
 - Unique demographics – India & China have huge younger and older populations. In Okinawa, Japan, 50% of the population is over 85 years of age.
 - Increasing human longevity (Dowling, Harvard study predicts average life expectancy of 118 in year 2050, up from 78 years in the US today)
 - Technology advancing at great speed, education falling behind
 - Population becoming intellectually obsolete much faster

Cottage Industry and Survivability`

- Survivability at the ‘individual- and species’ level is important
- Survivability is the fundamental principle of all biological organisms
- Mechanisms deployed
 - Adaptation – developing minor features to fit environmental changes
 - Reproduction – increasing the size of members of a species
 - Speciation – improving quality through mutation and selecting the fittest
- Acquisition of survivability characteristics
- Nature – inheritance, tacit knowledge (Mendel)—e.g., via DNA
- Nurture – Through environment, society, upbringing, explicit knowledge, education (Darwin)

Cottage Industry and Survivability (Cont'd)

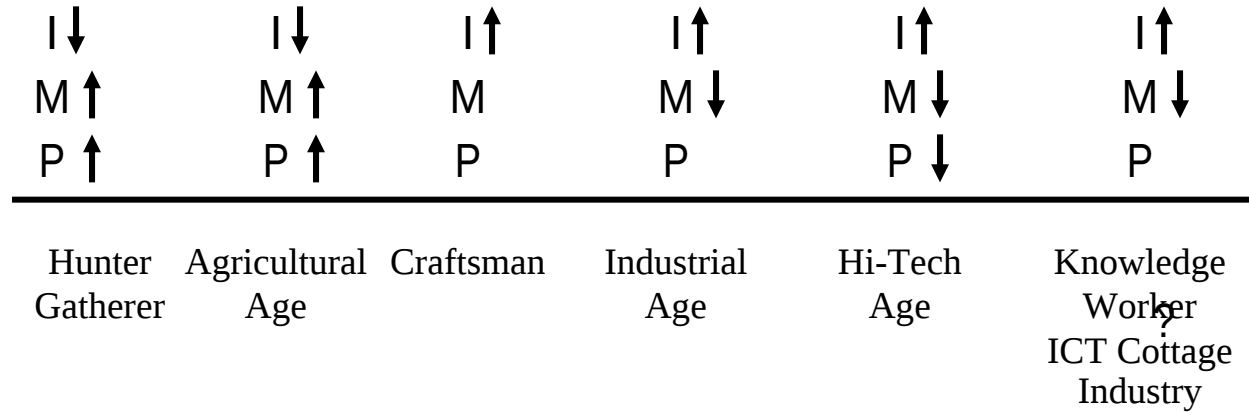
- A refined perspective of survivability
 - Improvement of value, measured by usefulness – similar concepts in Economics – liquidity (exchangeability, substitutability) and fringibility (replaceability of the same type)
 - Ex. Fossil oil, iron ore, uncut diamond are all useful only after refining/processing/cutting
 - Unstructured raw material have less immediate use and, therefore, value, example unrefined crude oil
- In the same vein, improving intelligence or mental acuity in the population will imply great usefulness and value to society, and we associate this with the ‘nurture ‘ aspects
- Critical role of the cottage industry will also be as teaching and learning function.

Conjecture, Hypothesis, Empirical Model, Data, Facts, Theory, Validation

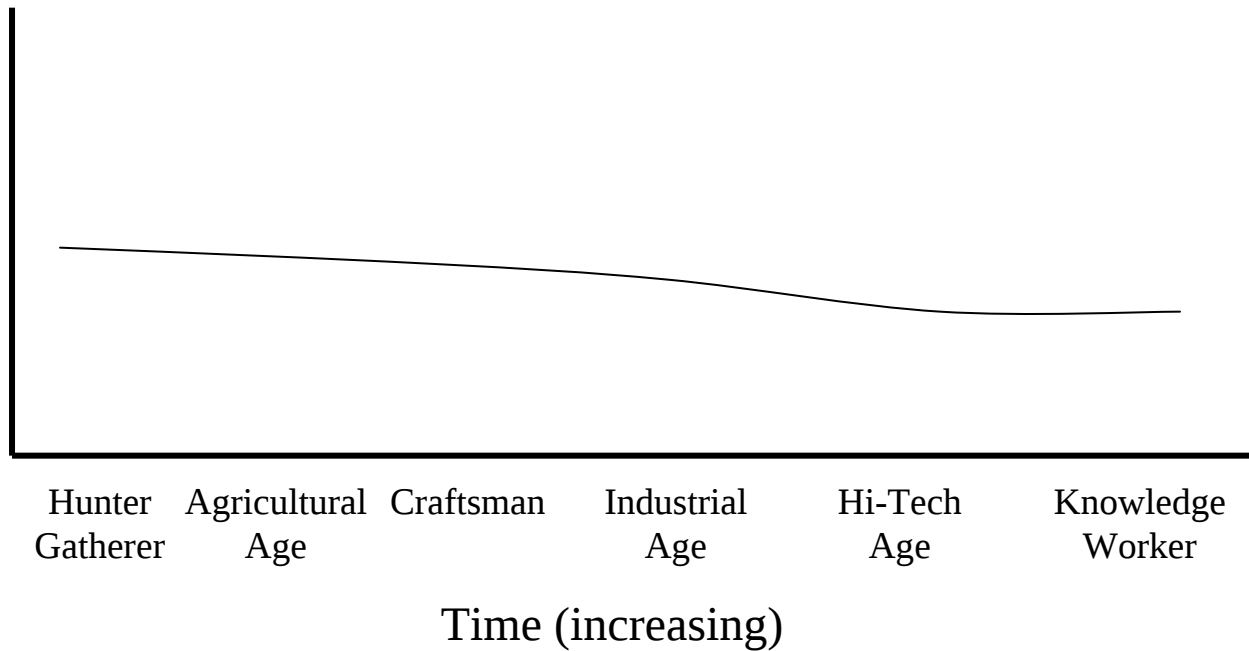
- We begin with
- A conjecture – this is a hypothesis
- Create an Empirical model
- Collect Data, which are transformed into Facts
- Refine the model,
- Develop the theory
- Validate

Evolution of Civilization

- Examine interplay of three key resources in the next slide
- I = intelligence; M = manual effort; P = primary of physical infrastructural resources;
- Up arrow qualifies significant or increasing; Down arrow implies low or diminishing; Absence of arrow implies neutral or unchanged.
- Every activity inevitably requires a combination of I, M, and P; however, the one that is predominant primarily characterizes the type of the activity.



SI=
Survivability
Index.
How well and
how long can
we survive



COMMENTS ABOUT THE HUMAN AGES AND RESOURCE DOMINANCE

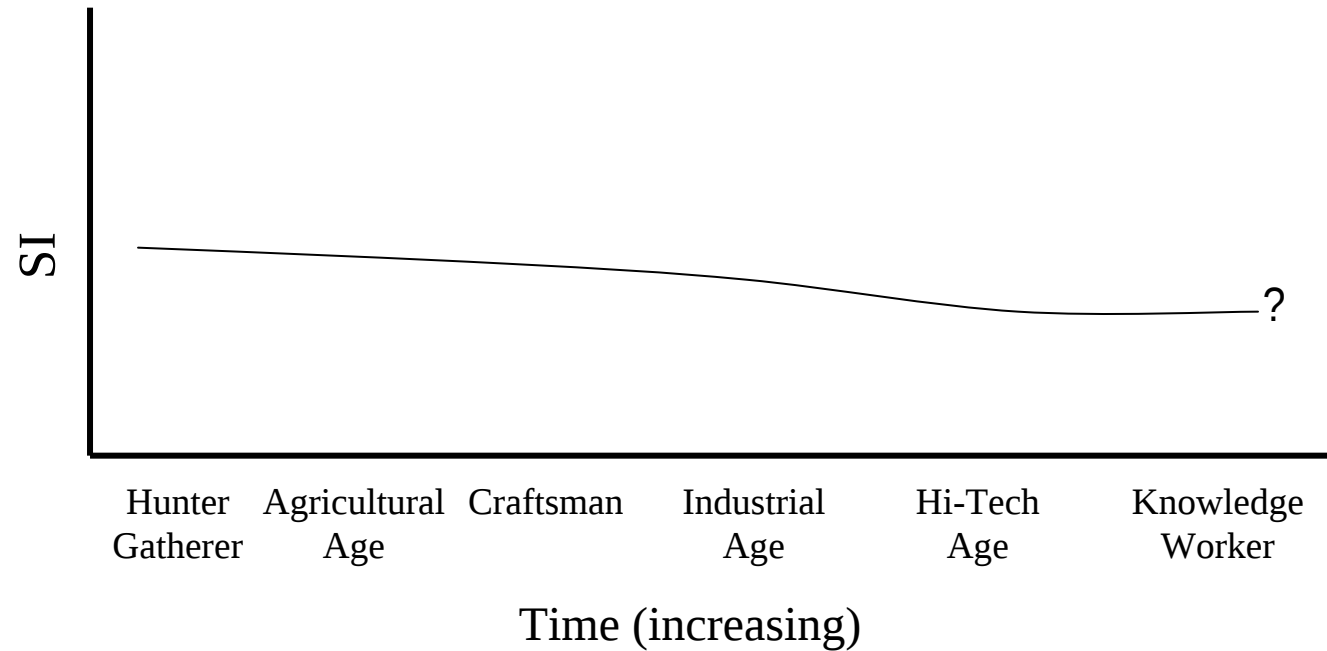
- WE SHALL COMMENT ON THE TABLE IN AN APPROXIMATE AND ABSTRACT WAY
- IMP-RESOURCE MODEL DISCUSSED LATER CAN HELP TO PREDICT THE TRENDS IN TECHNOLOGY AND INDUSTRY.
- SOME CONFIDENCE ABOUT OUR MODEL IS PROVIDED BECAUSE IT FULFILLS THE WINSTON CHURCHILL'S DICTUM—"THE FARTHER BACK YOU LOOK, THE FARTHER FORWARD YOU ARE LIKELY TO SEE"
- AT EACH SUBSEQUENT AGE,
- THE INTELLECTUAL RESOURCES GROW, THE MANUAL ACTIVITY RESOURCES ARE SHRINKING .
- THE UTILIZATION OF PHYSICAL RESOURCES IS GROWING AND THEREFORE THERE IS A GRADUAL DEPLETION OVER TIME .
WE ARE EXPERIENCING NATURAL RESOURCE SHORTAGES AND ENVIRONMENTAL DAMAGES.—REMEMBER MALTHUS.
- THE HUMAN COMMUNITY ALWAYS SOUGHT CONVINIENCE AND COMFORT, BY
- AVOIDING STRESSFUL MANUAL ACTIVITIES BY USING AUTOMATION AND TECHNOLOGY.
-

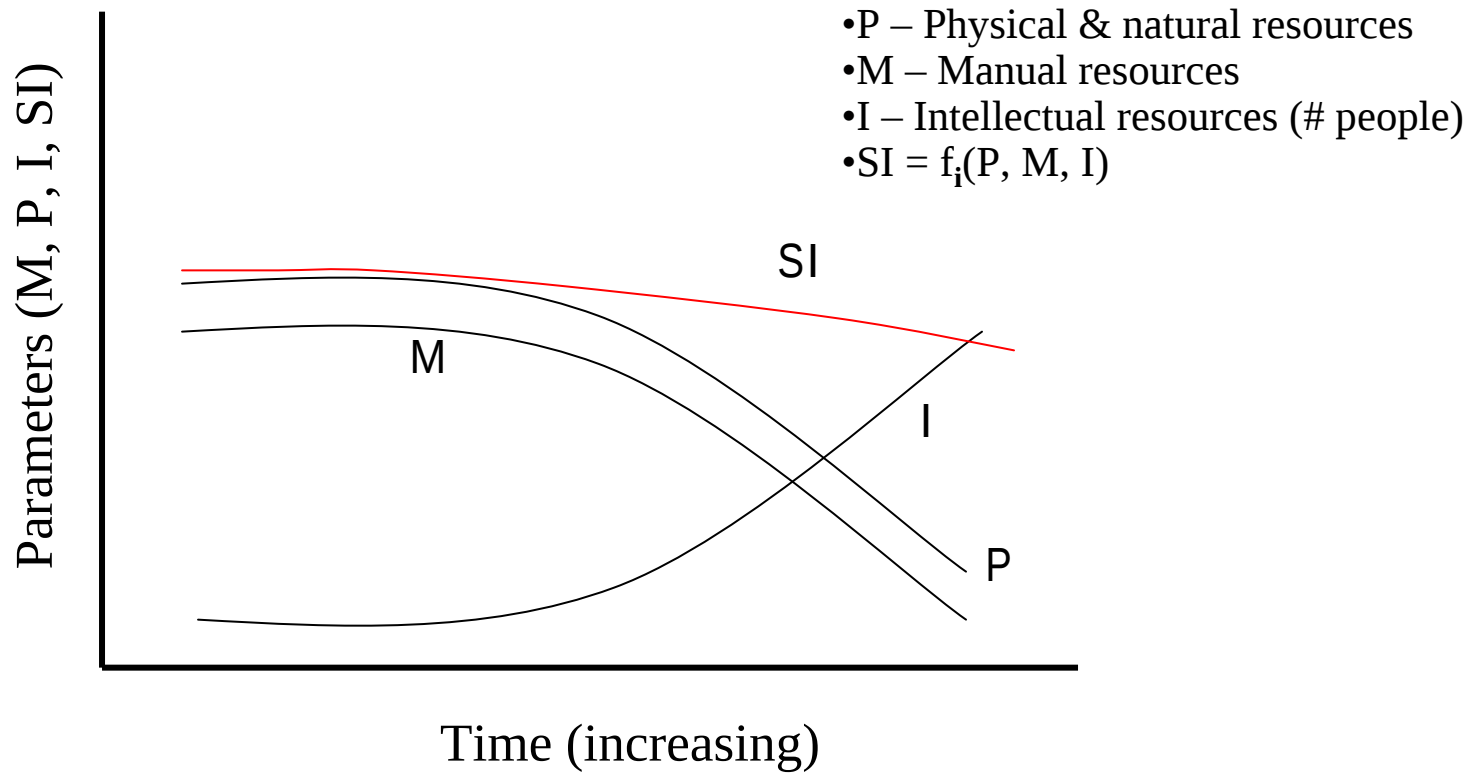
Evolution of Civilization

(The IMP Model and Importance of Convergence)

- Objective function for IMP model – predict the next likely scenario
- Principles/observations
 - Minimize manual labor, M , since biological body falters under stress
 - In the process, wanton abuse of non-renewable resource, P
 - Our survivability index, SI = Some product function of $(I \times M \times P)$
 - If any of I , M , or P goes to zero, SI goes to zero, our existence becomes a question
- Thus, optimization problem is complex
 - David Ricardo's Law – when resource availability is uneven, trade the one in excess for the one in short supply
 - Law of Increasing Returns (Arthur & Romer) – population growth accelerates intellectual growth, implying the growth of knowledge-based infrastructural assets
 - Trade “ I ,” which is in excess supply (given high population) for “ P ”, physical resources which are dwindling.

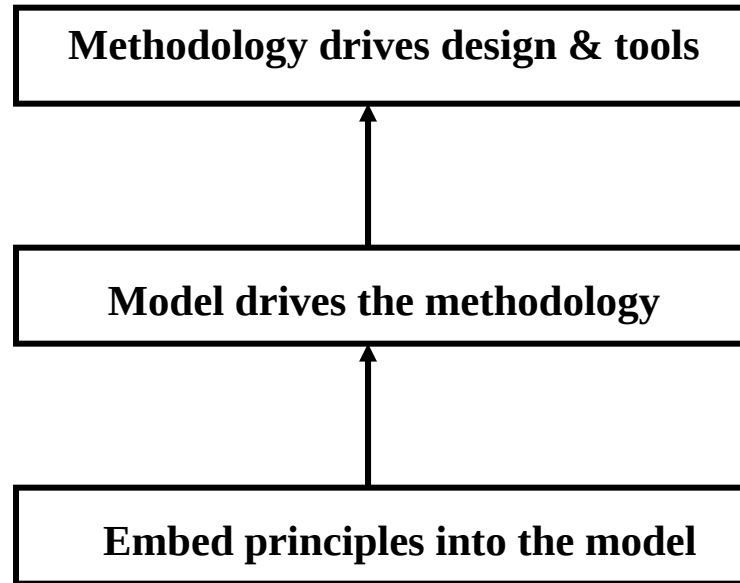
I ↓	I ↓	I ↑	I ↑	I ↑	I ↑
M ↑	M ↑	M	M ↓	M ↓	M ↓
P ↑	P ↑	P	P	P ↓	P
Hunter Gatherer	Agricultural Age	Craftsman	Industrial Age	Hi-Tech Age	Knowledge Worker





Optimizing Survivability Index (SI)

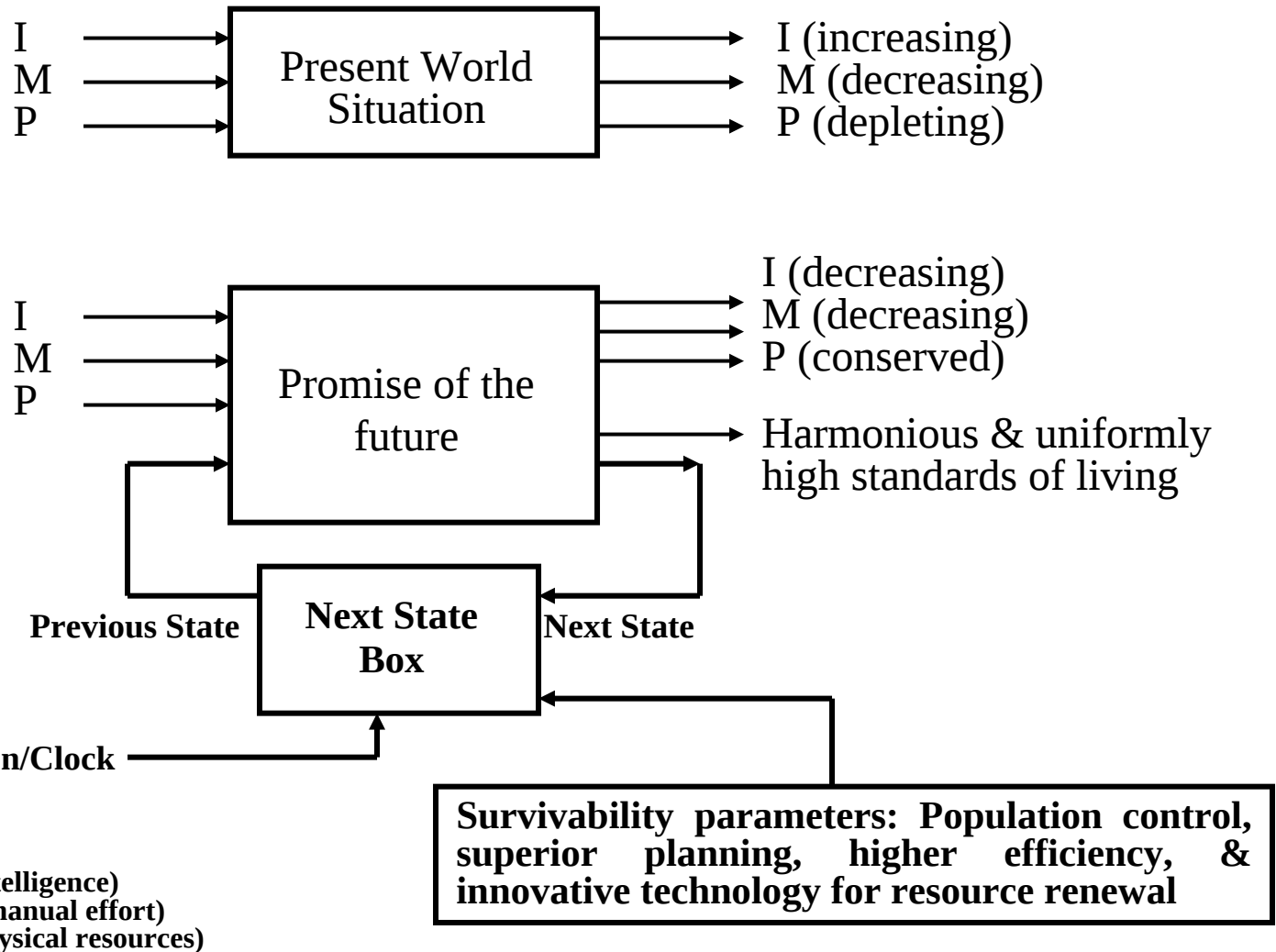
(Model-Driven Design Methodology)



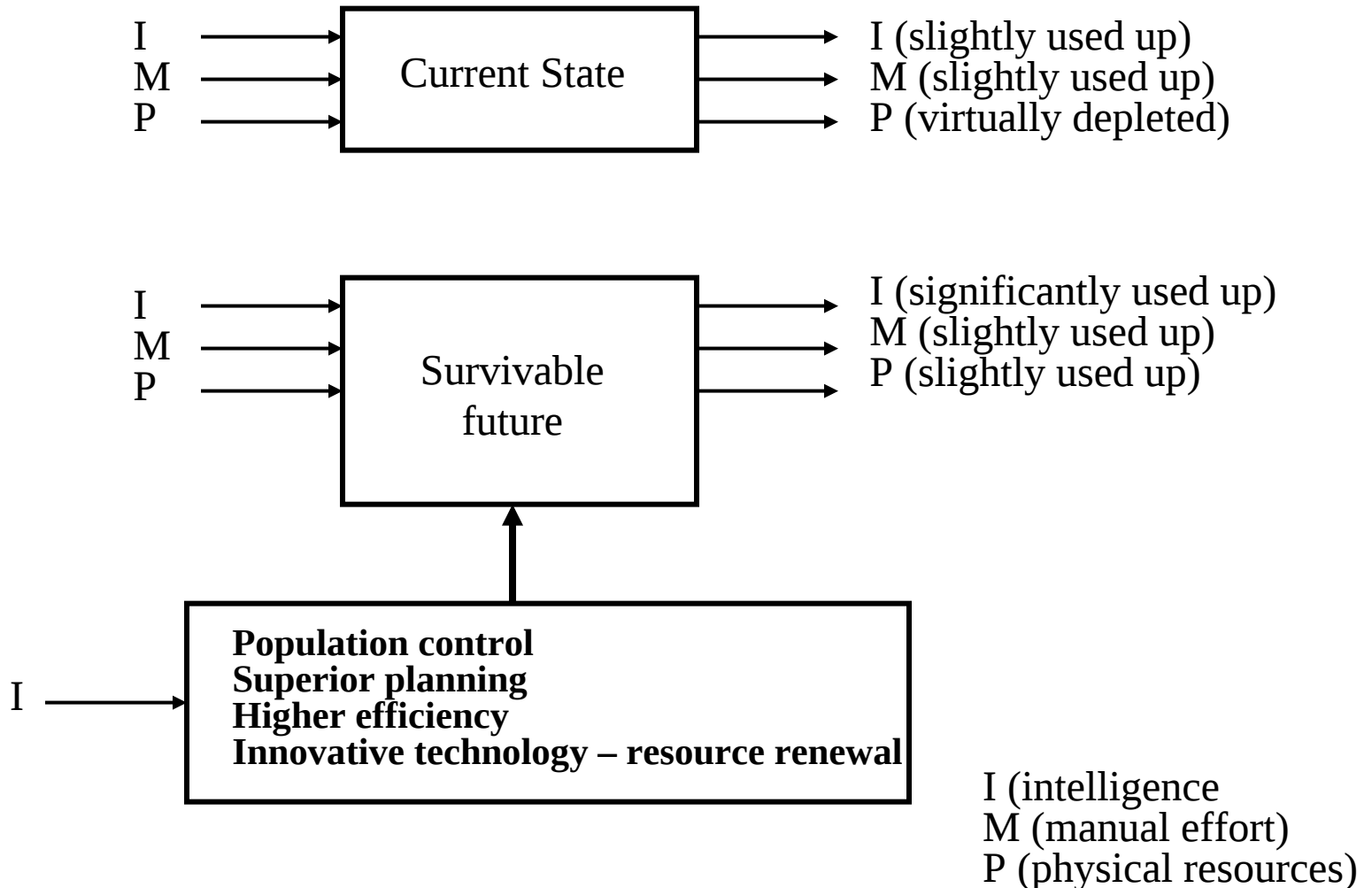
COMMENTS ABOUT THE IMP-R MODEL

- IMP-R MODEL WILL BE BASED ON THE ABOVE PRINCIPLES, AND WE CAN USE THE MODEL TO DEVELOP AND DRIVE THE DESIGN METHODOLOGIES OF SYSTEMS AND SERVICES. THUS THE DESIGNS WILL CONFORM TO THE PRINCIPLES AS INDICATED. THE PRINCIPLES HELP DERIVE THE MODELS AND MODELS HELP DRIVE THE DESIGNS AND METHODOLOGIES.
- IMP-R MODEL HELPS US PREDICT IN AN APPROXIMATE AND ABSTRACT FASHION THE FUTURE TRENDS IN HUMAN DISPOSITION, TECHNOLOGY AND INDUSTRY.
- ANN ANDREWS, ECONOMIST AND CONSULTANT PREDICTS
- “IN THE KNOWLEDGE AGE, (ABOUT 2020), 2% OF THE WORKING POPULATION WILL WORK ON THE LAND, 10% WILL WORK INDUSTRY, AND THE REST WILL BE KNOWLEDGE WORKERS”.
- IT FITS THE PREDICTION BASED ON OUR IMP-R MODEL

Survivable Future



Survivable Future



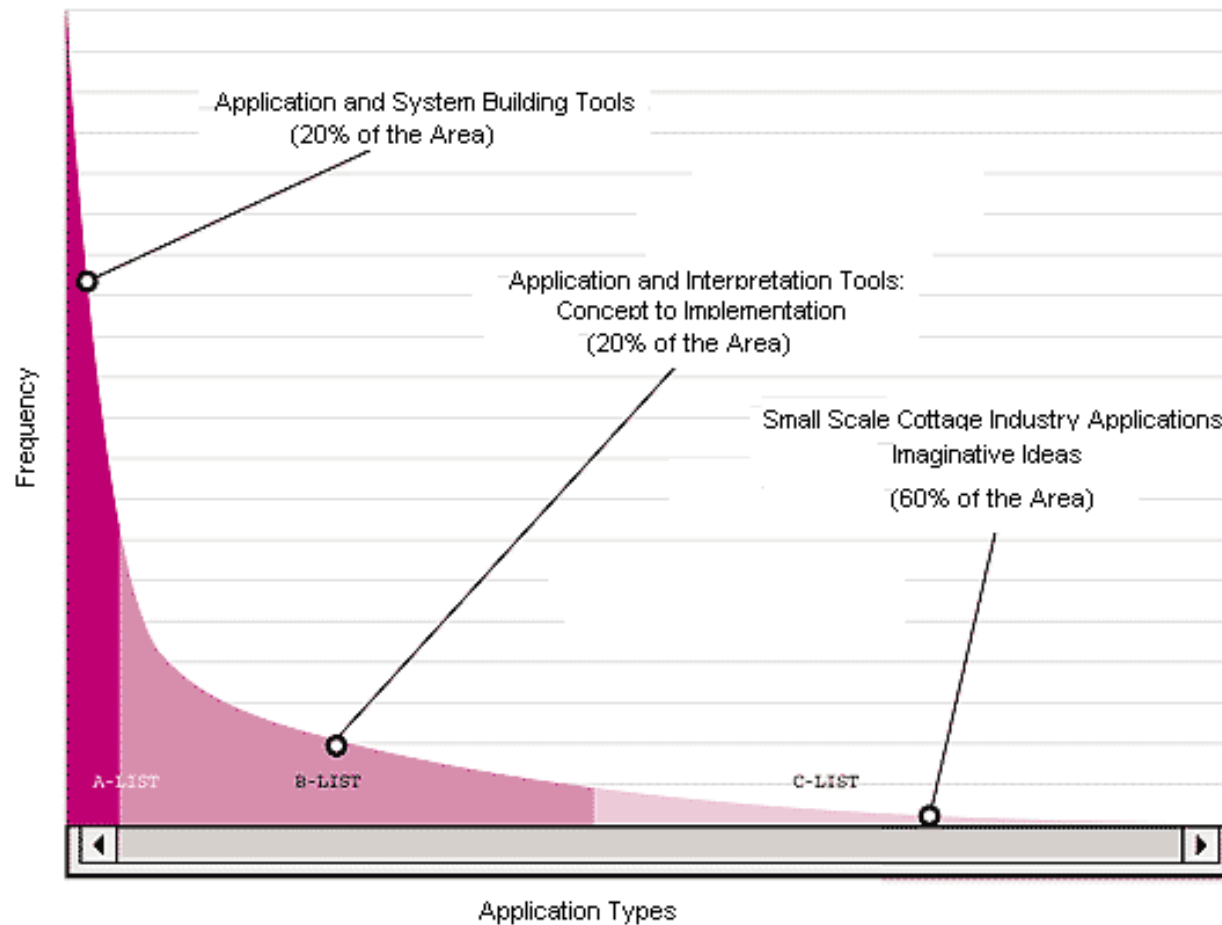
Long Tail Phenomenon and its Impact

(Chris Anderson)

■ Cottage Industry – Spectra of applications

- Dot Coms
- Games and entertainment
- Musical lyrics, notes, and implementation for feature films
- Wikis
- Small-scale knowledge workers
- Social networks
- Farm, agricultural, factory etc

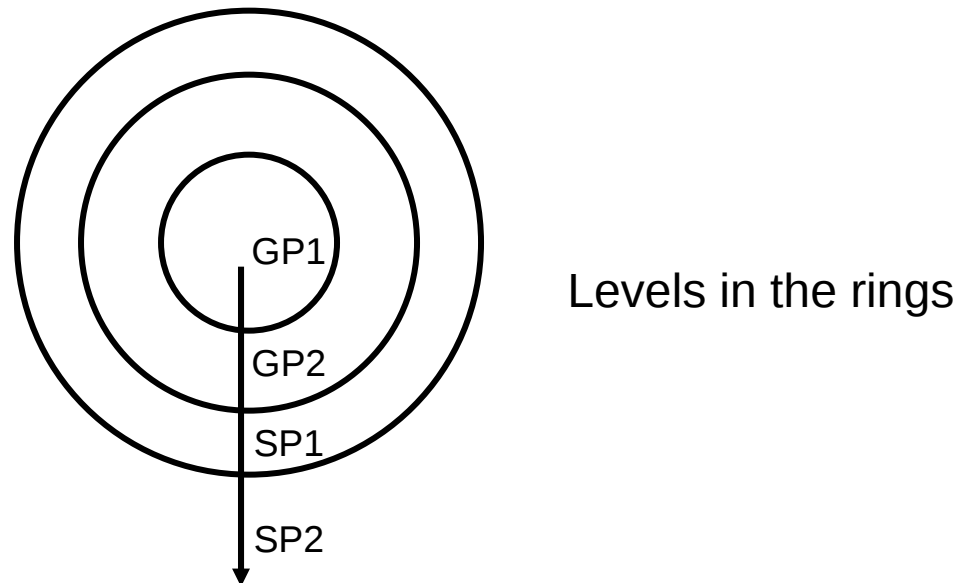
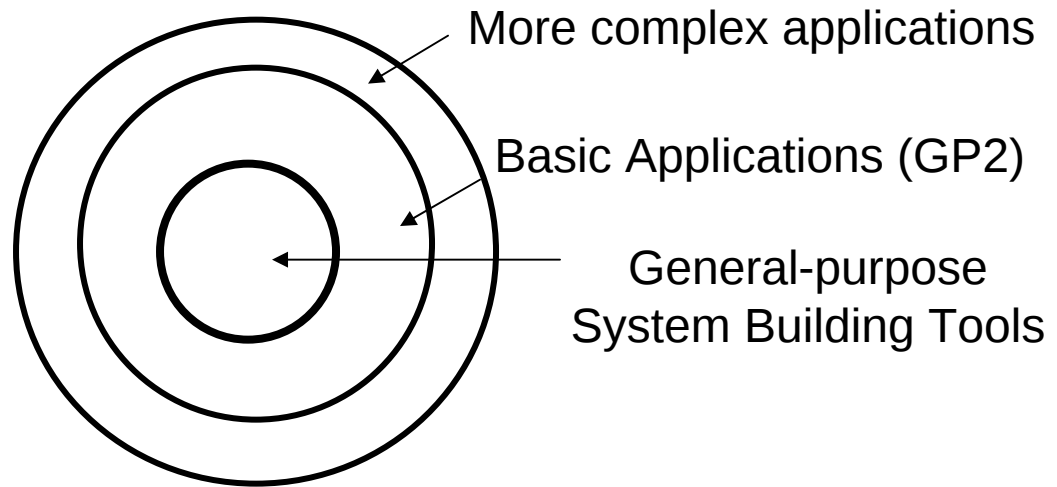
Long-Tail Distribution

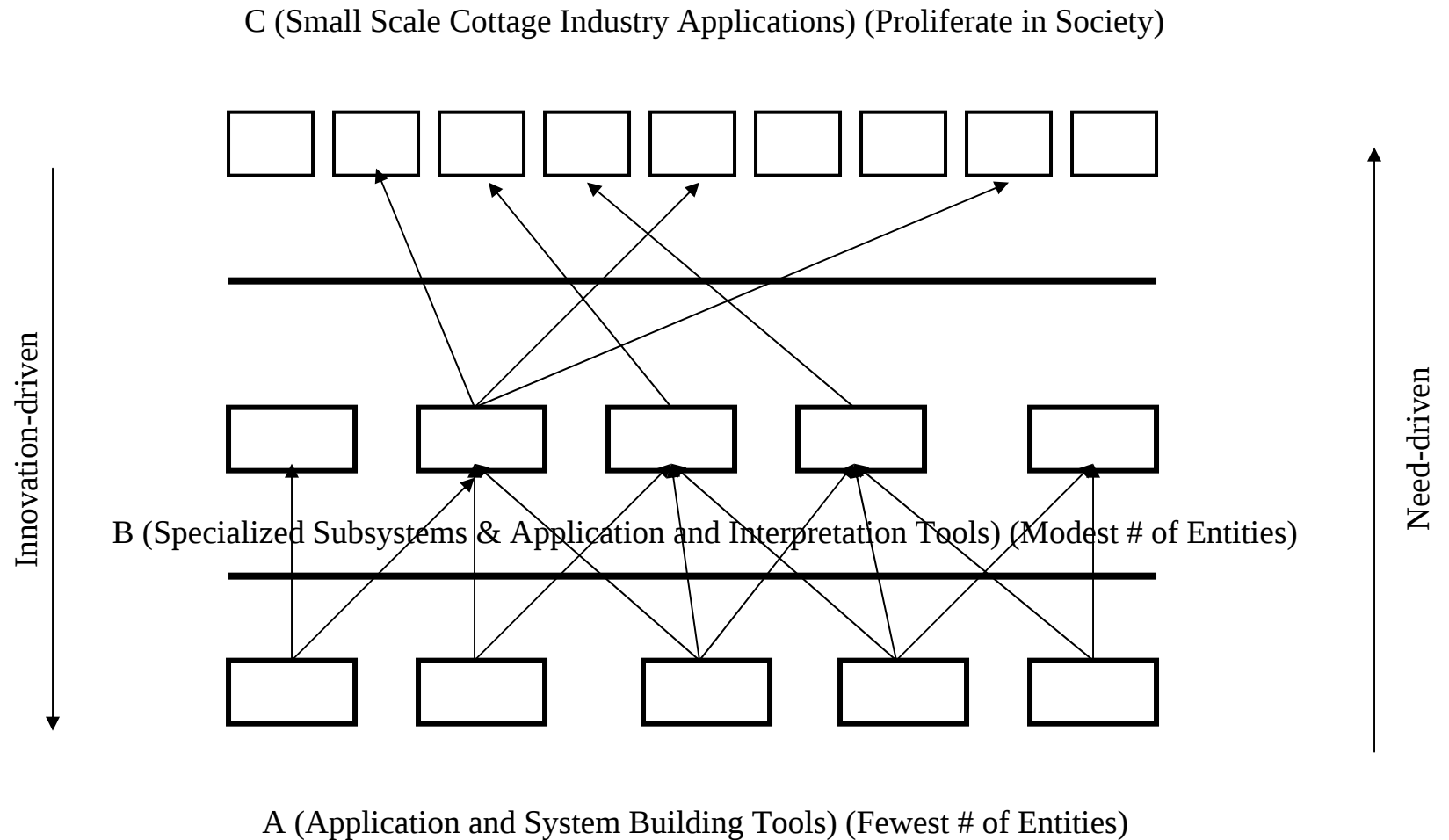


A-List: Commodity type applications

C-List: Individual-type, customizable, unique products and services

STRUCTURE OF APPLICATIONS





Call Centers – The Indian Experience

- E Seva: Government, tax advisory organization, permits mobile e-mail, voice recognition
- Ekalvya: kiosks in public places that provide general medical advice over the telephone, suggests nearby hospitals to seek medical attention, and can send heads up messages to the medical centers
- Farm-to-fork: Supplier (farmer) to consumer (fork) models—N Nilkani, Infosys, and M. Ambani, Reliance

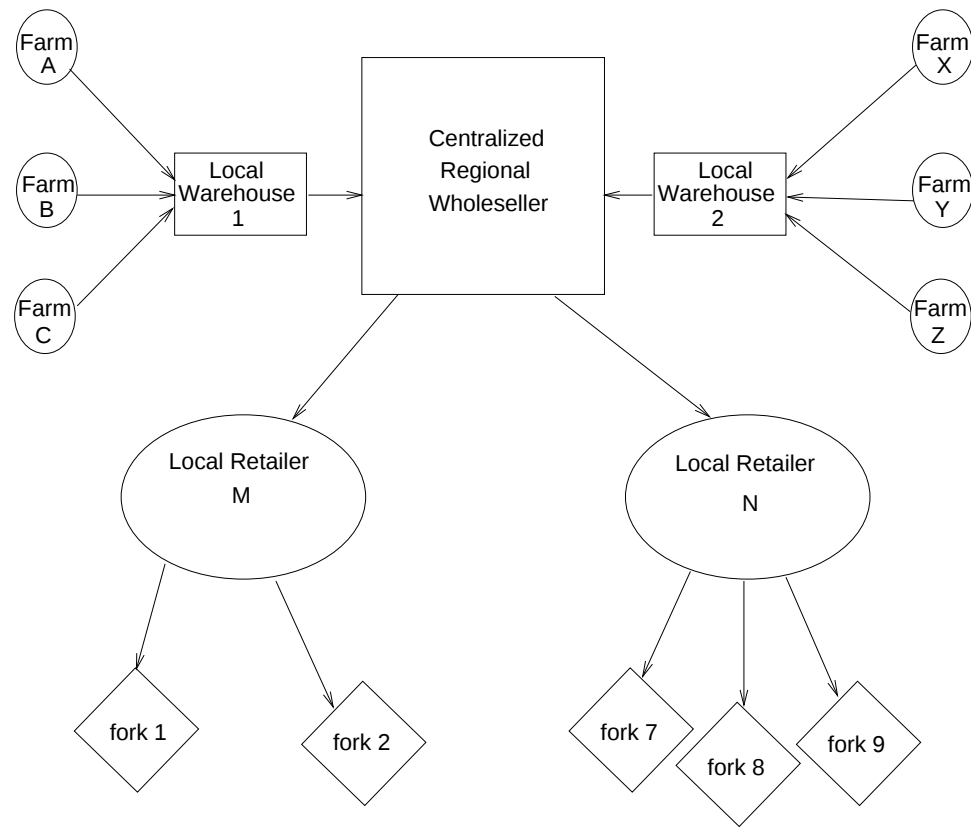


Figure 4: Farm-To-Fork Model

1. Arrows indicate flow of produce, grains, food, etc
2. Farms refer to producers while forks imply consumers
3. The warehouse and retailer are local but may not necessarily be in the same locality

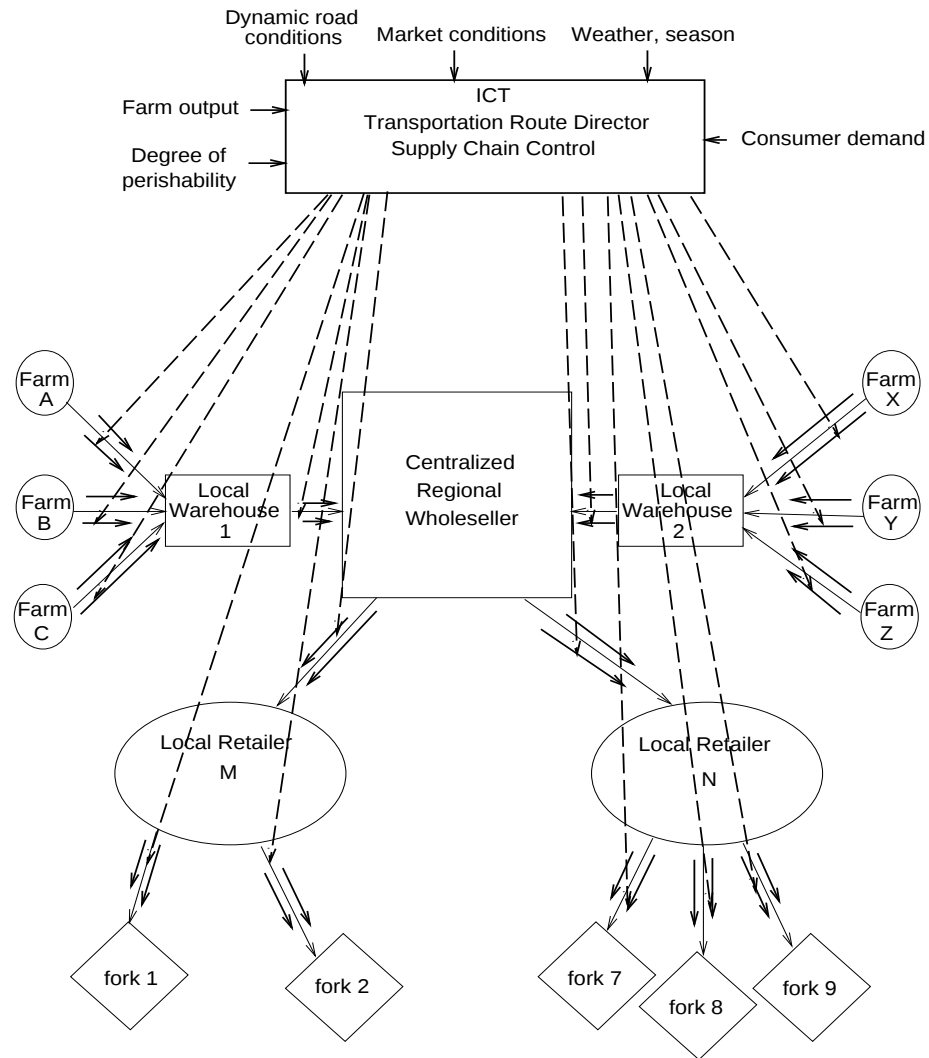
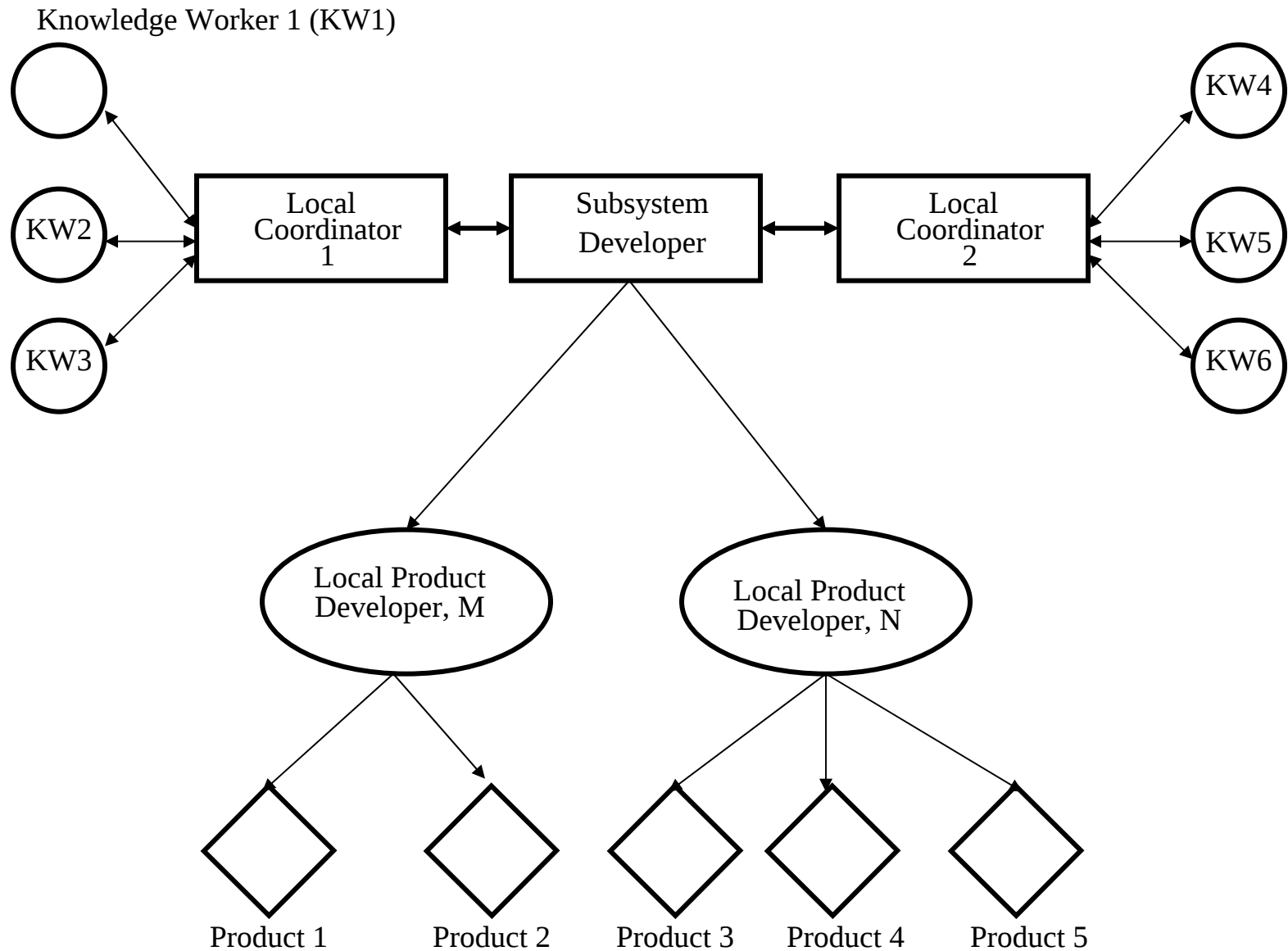


Figure 5: ICT Superimposed On Farm-To-Fork Model

1. Solid lines indicate potential physical transportation routes, e.g. ox-driven carts, trucks, railways, etc.
2. Dashed lines indicate control

Farm-to-Fork Model



Catching up with Developed Countries

- Developing countries may emulate the “Death of Distance” (Frances Cairncorn) – idea is that communication has shortened/reduced/killed distance
- Jet airlines have brought the furthest physical distances on earth closer
- Books and movies bring ancient authors alive across time to the present generation
- Telephone, mobile phone, Internet breaking down cultural barriers and bringing people from remote nations together
- Wikipedia and electronic libraries reducing the need for physical library
- Thus, distance is a relationship, capable of taking on different dimensions, and the goal is to eliminate distance between entities
- It is hoped that the cottage industry will, similarly,
 - bring death to the differential exploitation of non-renewable resources among developed and developing countries
 - Bring harmonious co-existence and cooperation among all nations
 - Reduce economic, knowledge, technology, wealth, educational, and cultural distance among people within and across nations

DISTANCE AND FLATNESS

- DEATH TO DISTANCE (F.CAIRNCORN) AND FLAT WORLD (T. FRIEDMAN) CONCEPTS---EXTENDED
- DISTANCE IMPLIES DEGREE OF DISSIMILARITY, DIFFICULTY AND DIFFERENCE BETWEEN ENTITIES
- COMMUNICATION TECHNOLOGIES SHORTENED, REDUCED OR KILLED DISTANCE
- JET ENGINES AND ROCKETS SHORTENED PHYSICAL DISTANCE
- ONE CAN APPLY THESE CONCEPTS TO OTHER PHENOMENA WHERE DISTANCES EXIST AND NEED TO BE SHORTENED, REDUCED , OR KILLED
- EDUCATION, KNOWLEDGE AND TECHNOLOGY—OPEN SYSTEMS AND WIKIS
- ECONOMICS –FLAT WORLD IDEAS OF T FRIEDMAN
- CULTURAL DISTANCES---MARTIN LUTHER KING, B OBAMA
- ENVIRONMENTAL DIFFERENCES DUE TO POVERTY AND UNDERDEVELOPMENTS

VALIDATION, PREDICTION, AND RISK

- THE FURTHER BACK YOU LOOK, THE FURTHER FORWARD YOU ARE LIKELY TO SEE – W. CHURCHILL
- THE PATEL STRATEGY (ALSO PRACTICED BY W. BUFFETT)
- “HEADS I WIN, TAILS I LOSE NOT MUCH”—RISK AVERSE STRATEGY
- OUR IMP-R MODEL CAN BENEFIT FROM THESE INSIGHTS

Conclusions

- We are facing a critical problem and standing at a threshold
- Not only are the challenges for the developing nations exceptionally important, issues of resource limitation and environmental poisoning are threatening life on earth
- We must try hard to preempt the Malthusian catastrophe stemming from the issues of environment, resources, population, and lack of equity
- This presentation offers a partial model in the form of an abstraction
- The vision presented here must be weaved into every product, service, projects, and activity
- The cottage industry approach promises an inexpensive way of achieving genuine prosperity, better standard of living, and harmonious living
- Not only is relevant information delivered to the needy in a timely manner, resources are not stressed, people are not at each others' throats, and it is good model to educate all of us in cooperation and collaboration
- William Wordsworth (English poet) had written, "Plain living and high thinking." For 21st century, we might say, "Green living and collaborative thinking."

Questions and Feedback