INNOVATION GLOSSARY

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CONTENTS

EXPLANATION OF SIGNS

OM Own materials, definition by the author
SP Science Policy. A Working glossary by NSF
@ Not defined yet

> see
>> see also

OM Eigene Materialien, Definitionen des Verfassers
SP Science Policy. A Working glossary by NSF
@ Noch nicht definiert

> siehe
>> siehe auch

OM Sobstvennye materialy, opredelenija avtora
SP Nauchnaja Politika . Rabochij slovar' Neshionel Sajnc Faundeshn
@ Het eshche opredelenija

> smotri
>> smotri tozhe

PREFACE

> Denn ueberall, wo die Begriffe fehlen, da stellt ein Wort zur rechten Zeit sich ein. Mit Worten laesst sich trefflich streiten, mit Worten ein SYSTEM bereiten...
>
> Goethe, *Faust I*

There is little doubt that the mutual understanding of scientists has deteriorated since the Middle Ages, when Latin was the universal language of science. I once asked a colleague of mine in Sofia, Professor Kinov, why it was that more than two thousand years ago the two monks Cyrill and Methodius found it necessary to complicate written language by introducing the Cyrillic alphabet. Life would have been far simpler if they had only adhered to the use of Latin script.

His reaction surprised me. Obviously somewhat annoyed, and completely disregarding the economic benefits of my proposal, he retorted that he would find a world with a uniform script, or indeed with a uniform language, extremely boring.

On reflection, I concluded that Professor Kinov was absolutely right. Maybe there is even some fun to be had in writing a glossary, as one discovers translations (actually a sort of "mislations") and makes one's readers into (positive as well as negative) Princes of Serendip.

The IIASA research task on innovation was launched at a point in time when the diffusion of this research topic over many countries in both East and West had begun to reach notable proportions. In the 1960s, one could not have found more than a slim bibliography on innovations in most of these countries; today such a bibliography would constitute a very solid book. This information explosion can be laid to the increasing

number of scientists in various fields have begun dealing with this problem.

Before the recent wave of scientific literature on innovations, a similar wave of literature in the 1960s on problems of research and development paved the way for the innovation research boom as its logical continuation.

The magnitude of the flood of available information is hampering its practical use. Nowhere in the literature are the basic operational prinicples and tools of innovation explained. This gap in the literary market is accompanied by an urgent need for a synopsis for scientific and practical purposes.

Innovations, of course, appear in a very broad range of technical, economic, and social areas. It is where they touch on such fields as decision analysis, resources and environment, and risk analysis that the subject becomes of particular interest to IIASA. I have attempted to show this to a certain extent in the first draft of a Glossary of Innovation Terms.

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Code: OM

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g Anpassung
r *Prisposoblenie*
Code: SP

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g Adoptionsprozess
r *Process prinjatija novovvedenija*
Code: OM

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g Progressive Energietechnologien
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Code: SP

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r *Agrarno- promyshlennyj kompleks*
Code: SP

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g Algorithmus
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r *Algorifm, evristichnyj*
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Code: SP

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r *Fundamental'naja innovacija revoljucionnoe izmenenie texniki*
> Classification of innovations Historical taxonomy of innovations
Code: @

e Basic research
g Grundlagenforschung
r *Fundamental'noe issledovanie*
> Basic research
Code: @

e Benefit
g Nutzen, Vorteil
r *Pol'za vygoda*
Code: @

e Benefit/Cost Analysis
g Nutzen-Kosten-Analyse
r *Analiz resul'tatov i zatrat*
> Cost/Benefit Analysis
Code: @

e Benefit/Risk Analysis
g Nutzen-Risiko-Analyse
r *Analiz pol'zy i riska*
> Risk/Benefit Analysis
Code: @

e Big Science
g Grossforschung
r *Bol'shaja nauka*
Code: @

e Biotechnology
g Biotechnologie
r *Biotexnologija*
Code: SP

e Objective (noun)
g Kriterium
Ziel
r *Kriterij*
cel'
Code: SP

e Bottleneck
g Flaschenhals
Engpass
r *Uzkoe mesto*
Code: @

e Brain drain
g Brain drain
r *Brejn drejn*
Code: @

e Breakeven point
g Gewinnschwelle
Kostenschwelle
r *Porog effektivnosti*
Code: OM

e Capital
g Kapital,
Fonds
r *Kapital,*
fondy
Code: @

e Capital coefficient
capital-output ratio
g Kapitalkoeffizient
Fondsintensitaet
r *Kapitaloemkost'*
Fondoemkost
Code: OM

e Capital Goods Industry
g Kapitalgueterindustrie,
Herstellung von Produktionsmitteln
r *Proizvodstvo sredstv proizvodstva dlja proizvodstva sredstv proizvodstva*
Code: OM

e Choice
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r *Vybor*
Code: @

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r *Analiz citatov*
Code: SP

e Classification of innovations
g Klassifizierung von Innovationen
r *Klassifikacija novovvedenij*
>> Historical taxonomy of innovations
Code: OM

e Closed cycle
g Geschlossener Kreislauf
r *Zakrytij krugovorot*
Code: SP

e Communication
g Kommunikation
r *Kommunikacija*
Code: SP

e Compensation
g Ausgleich
r *Kompensacija*
Code: @

e Competition
g Konkurrenz
Wettbewerb
r *Konkurencija*
sorevnovanie
Code: @

e Complex, agro-industrial
g Komplex, agro/industrieller
r *Kompleks, agravno-*
promyshlennyi
> Agro-Industrial Complex
Code: @

e Complexity of innovations
g Komplexitaet der
Neuerungsprozesse
r *Kompleksnost' novovvedenij*
Code: OM

e Composition rules
g Regeln der Zusammenfassung
r *Pravila sinteza*
Code: @

e Condition
g Bedingung
r *Uslovie*
Code: OM

e Condition, Necessary
g Bedingung, notwendige
r *Uslovie, neobxodimoe*
Code: OM

e Condition, necessary and
sufficient
g Bedingung, notwendige und
hinreichende
r *Uslovie, neobxodimoe i dostato-*
chnoe
Code: OM

e Condition, sufficient
g Bedingung, hinreichende
r *Uslovie, dostatochnoe*
Code: OM

e Conservation of resources
g Ressourcenoekonomie
r *Ekonomija resursov*
Code: SP

e Constraint
g Restriktion, Nebenbedingung
r *Ogranichenie*
Code: SP

e Cost-Benefit Analysis
g Kosten-Nutzen-Analyse
r *Analiz zatrat i rezul'tatov*
>> Risk/ Benefit Analysis
Code: SP

e Cost/effectiveness analysis
g Aufwands-Effektivitaetsanalyse
r *Analiz zatrat/effektivnosti*
Code: SP

e Creativity
g Kreativitaet
Schoepfertum
r *tvorchestvo*
Code: OM

e Creativity and routine experience
g Kreativitaet und Routineerfahrung
r *Tvorchestvo i rutinnyj opyt*
Code: OM

e Creativity indicators
g Kreativitaetskennziffern
r *Pokazateli tvorchestva*
Code: OM

e Criterion
g Kriterium
r *Kriterij*
Code: SP

e Critical path method
g Methode des kritischen Weges
r *Metod kriticheskogo puti*
Code: @

e Cross Impact Matrix Analysis
g Analyse der Krenzbeeinflussungsmatrix
r *Analiz matricy vzaimnogo vlijanija*
Code: SP

e Cross-section analysis
g Querschnittsanalyse
r *Analiz po poperechnomu razrezu*
Code: @

e Ideal point (Solution)
g Ideale Loesung
r *Ideal'noe reshenie*
Code: @

e Decision Analysis
g Analyse von Entscheidungen
r *Analiz reshenij*
Code: @

e Decision models
g Entscheidungsmodelle
r *Modeli prinjatija reshenij*
Code: @

e Decision rule
g Entscheidungsregel
r *Pravilo prinjatija reshenij*
Code: @

e Decision Support for Innovations
g Entscheidungsvorbereitung fuer Innovationen
r *Podgotovka reshenij dlja novovvedenija*
Code: OM

e Decision Theory
g Entscheidungstheorie
r *Teorija reshenija*
Code: SP

e Decision Tree
g Entscheidungsbaum
r *Derevo reshenija*
Code: OM

e Defect
g Defekt
r *Defekt*
>> Gap
Code: OM

e Degree of utilization
g Auslastungsgrad
r *Stepen' izpol'zovanija*
Code: @

e Delphi Method
g Delphimethode
r *Metod Del'fi*
Code: SP

e Demand
g Nachfrage
Bedarf
r *Spros*
potrebnost'
Code: @

e Demand Pull Hypothesis
g Nachfragehypothese
Beduerfnisdruckhypothese
r *Gipotesa prisasyvanija sprosom*
gipotesa prisasyvanija potrebnostju
>> Science Push Hypothesis
Code: OM

e Department I and II of social production
g Abteilung I und II der gesellschaftlichen Produktion
r *Otdelenie I i II obshchestvennogo proizvodstva*
Code: OM

e Descriptive models of multiobjective decision making
g Deskriptive Modelle der Entscheidungsfindung unter mehrfacher Zielsetzung
r *Deskriptivnye modeli reshenija mnogokriterial'nych problem*
Code: @

e Determinants of innovative activities in Industrial Organizations
g Determinanten der Neuerungstaetigkeit in der Industrie
r *Determinanty novovvedencheskoj dejatel'nosti v promyshlennyx organisacijax*
Code: OM

e Development
g Entwicklung
r *Razrabotki*
>> Research
Code: SP

e Diffusion
g Diffusion
Verbreitung
r *Rasprostranenie*
Code: SP

e Direct methods of multiobjective decision making
g Direkte Methoden der Entscheidungsfindung unter mehrfacher Zielsetzung
r *Prjamye metody prinjatija mnogokriterial'nyx reshenij*
Code: @

e Directive
g Direktive
r *Direktiva*
Code: OM

e Discounting
g Diskontierung
r *Diskontirovanie*
Code: SP

e Disequilibrium
imbalance
g Ungleichgewicht
r *Neravnovesie*
Code:

e Dominance
g Dominanz
r *Dominirovanie*
Code: @

e Dynamic efficiency
g Dynamische Effektivitaet
r *Dinamicheskaja effektivnost'*
Code: @

e Economic division
g Wirtschaftsbereich
Wirtschaftsektor
r *Narodno- xozjajstvennaja otrasl'*
Code: @

e Economic indicators
g Wirtschaftskennzahlen
r *Ekonomicheskie pokazateli*
Code: SP

e Economy of scale
g Einsparung durch Vergroesserung
r *Ekonomija za schet uvelichenija*
Code: SP

e Ecosystem
g Oekosystem
r *Ekosistema*
Code: SP

e Effectiveness
g Effektivitaet
r *Effektivnost'*
Code: OM

e Efficacy of factors, influencing innovations
g Effizienz der Faktoren, die Neuerungen beeinflussen
r *Effektivnost' faktorov, vlijajushchie na novovvedenii*
>> Factors influencing Innovations
Code: OM

e Efficacy, technical
g Wirkungsgrad, technischer
r *Koefficient poleznogo dejstvija, texnicheskij*
> Effectiveness
Code: @

e Efficiency
g Effektivitaet
Nutzeffekt
r *Effektivnost'*
> Effectiveness
>> Efficiency Cycle
Code: @

e Efficiency Cycle
g Effektivitaetszyklus
r *Cikl effektivnosti*
Code: OM

e Efficiency impact of basic and improvement innovations
g Effektivitaetswirkung von Basis- und Verbesserungsinnovationen
r *Vliyanie krupnych i malen'kich novovvedenij na effektivnost'*
Code: OM

e Ekistics
g Oekistik
r *Ekistika*
Code: SP

e Energy
g Energie
r *Energija*
Code: SP

e Energy conversion
g Energieumwandlung
r *Preobrazovanie energii*
Code: SP

e Engineering
g Ingenieurwesen
r *Inzhenernoe obrazovanie*
Code: SP

e Enquiry
Inquiry
g Erhebung
Befragung
r *Opros*
Code:

e Enterprise
g Unternehmung
Unternehmen
r *Firma*
Code:

e Entrepreneur
g Unternehmer
r *Predprinimatel'*
Code: @

e Entrepreneurship
g Unternehmensfuehrung
Unternehmensleitung
r *Predprinimatelstvo*
Code: @

e Entropy
g Entropie
r *Entropija*
Code: SP

e Environment
g Umwelt
Umgebung
r *Okrushajushchaja sreda*
Code: SP

e Equilibrium
g Gleichgewicht
r *Ravnovesie*
Code: @

e Evaluation
g Bewertung
r *Ocenka*
Code: OM

e Expansionary Investment
g Extensive Investitionen
r *Ekstensivnye kapital'nye vlozhenija*
Code: @

e Exploratory Forecasting
g Erkundungsprognose
r *Issledovatelskoe prognozirovanie*
> Forecasting, Exploratory
Code: @

e Exploratory Research
g Erkundungsforschung
r *Razvedyvatel'noe issledovanie*
> Research, Exploratory
Code: @

e Externalities
g Aeussere Effekte
r *Vneshnie effkti*
Code: SP

e Extrapolation in Forecasting
g Extrapolation, prognostische
r *Ekstrapoljacija v prognozirovanii*
Code: OM

e Facilities
g (guenstige) Moeglichkeiten
r *Blagoprijatnye uslovija*
Code: @

e Factor of Production
g Produktionsfaktor
r *Faktor proizvodstva*
Code: OM

e Factors influencing Innovations
g Faktoren, die Neuerungen beeinflussen
r *Faktory, vlijajushchie na novovvedenii*
Code: OM

e Feasibility study
g Vorstudie, in der Moeglichkeiten und Alternativen abgeklaert werden
r *Predvaritel'noe izuchenie realizuemosti*
Code: @

e Feedback
g Rueckkopplung
r *Obratnaja svjaz'*
Code: SP

e Figure of Merit
g Ergebnisfunktion
Leistungsprofil
r *Itogovaja funkcija*
Code: SP

e Final good
g Endprodukt
Finalprodukt
r *Konechnyj produkt*
Code: @

e Finished good
g Fertigerzeugnis
r *Gotovoe izdelie*
Code: @

e Fixed asset
g Anlagekapital
Grundfonds
r *Osnovnye fondy*
Code: OM

e Fixed capital
g Anlagefonds
Anlagevermoegen
r *Osnovnye fondy*
Code: @

e Fixed capital formation
g Anlagefondsbildung
r *Obrazovanie osnovnych fondov*
Code: @

e Fixed investment
g Anlageinvestitionen
r *Kapital'nye vloshenija v osnovnye fondy*
Code: @

e Flexibility
g Flexibilitaet
r *Izmenchivost', elastichnost'*
Code: @

e Flow
g Fluss
r *Potok*
Code: @

e Flow chart
g Flussdiagramm
r *Diagramma potokov*
Code: @

e Flow figure
g Bewegungszahl
Stroemungsgroesse
r *Velichina techenija*
Code: @

e Food Chain
g Nahrungsmittelkette
r *Prodovolstvennaja cepochka*
Code: SP

e Forecast
g Prognose
Vorausberechnung
r *Prognoz*
Code: SP

e Forecasting Methods-basic terms
g Prognosemethoden - Grundbegriffe
r *Metody prognozirovanija - osnovnye ponjatija*
Code: OM

e Forecasting, exploratory
g Erkundungsprognose
r *Razvedyvatelnoe prognozirovanie*
Code: OM

e Forecasting, Normative
g Prognose, normative
r *Prognozirovanie, normativnoe*
Code: OM

e Free-market economy
g Freie Marktwirtschaft
r *Rynochnaja ekonomika*
Code: @

e Frontier Models
g Modelle der Effektivitaetsgrenze
r *Modeli predel'noj effektivnosti*
Code: @

e Functions of human labor
g Arbeitsfunktionen des Menschen
r *Trudovye funkcii cheloveka*
Code: OM

e Functions of Innovations in a System
g Funktionen der Neuerung in einem System
r *Funkcii novovvedenija v sisteme*
> Classification of Innovations
Code: @

e Fundamental Research
g Grundlagenforschung
r *Fundamental'noe issledovanie*
> Research Fundamental
Code: @

e Futures Research
g Zukunftsforschung
r *Issledovanie budushchego*
Code: SP

e Fuzzy set
g Unbestimmte Menge
r *Razmytoe mnozhestvo*
Code: @

e Game Theory
g Spieltheorie
r *Teorija igr*
Code: SP

e Gap
g Luecke
r *Otstavanie*
Code: @

e Genesis of new technologies
g Genesis neuer Techniken
r *Genesis novoj texniki*
Code: OM

e Global effects
g Globale Wirkungen
r *Global'nye posledstvija*
>> Goal
Code: SP

e Goal programming
g Zielprogrammierung
r *Celevoe programmirovanie*
Code: @

e Goals, national
g Ziele, nationale
r *Celi, nacional'nye*
Code: @

e Gross capital formation
g Bruttokapitalbildung
r *Obrazovanie valovogo kapitala*
Code: @

e Gross domestic product GDP
g Bruttoinlandsprodukt
r *Valovoj nacional'nyj produkt*
Code: @

e Gross national product GNP
g Bruttosozialprodukt
r *Valovoj nacional'nyi produkt*
Code: @

e Group decision making
g Gruppenentscheidungsfindung
r *Gruppovoe prinjatie reshenii*
Code: @

e Growth industry
g Wachstumsindustrie
r *Rastushchaja otrasl' promyshlennosti*
Code: @

e Growth policy
g Wachstumspolitik
r *Politika rosta*
Code: @

e Growth rate
g Wachstumsrate
r *Temp rosta*
Code: @

e Growth target
g Wachstumsziel
r *Cel' rosta*
Code: @

e Hardware
g Hardware
r *Xarduejr*
Code: SP

e Harmonization
g Harmonisierung
r *Garmonizacija*
Code: @

e Heavy industry
g Schwerindustrie
r *Tjazholaja promyshlennost'*
Code: @

e Heuristic
g Heuristik
r *Evristika*
Code: OM

e Heuristic Algorithm
g Heuristischer Algorithmus
r *Evristichnyj algorifm*
> Algorithm, Heuristic
Code: @

e Heuristic problem solving
g Heuristische Problemloesung
r *Evristicheskoe reshenie problem*
Code: @

e Hierarchical structure
g Hierarchiestruktur
r *Ierarxicheskaja struktura*
Code: OM

e Historical taxonomy of innovations
g Historische Taxonomie von Neuerungen
r *Istoricheskaja ocenka novovvedenij*
>> classification of innovationsHolistic
Code: OM

e Homeostasis
g Homoeostasis
r *Gomeostasis*
Code: SP

e Human Capital
g Bildungskapital Bildungsfonds
r *Fondy obrazovanija*
Code: OM

e Human relations
g Zwischenmenschliche Beziehungen
r *Mezhchelovecheskie otnoshenija*
Code: @

e Human resources
g Arbeitskraefteressourcen
r *Resursy rabochej sily*
Code: @

e Impact
g Auswirkung
r *Posledstvie*
Code: SP

e Implementation
g Einfuehrung Umsetzung
r *Vvedenie*
Code: @

e Implementation into production
g Ueberleitung in die Produktion
r *Osvoenie na proizvodstva*
Code: @

e Improvement Innovation
g Verbesserungsinnovation evolutionaere Neuerung
r *Evoljucionnoe izmenenie texniki*
> Classification of Innovations
Code: @

e Incremental
g In kleinen Schritten zunehmend
r *Medlenno progressirujushchij*
Code: SP

e Indicators of innovations
g Kennziffern von Innovationen
r *Pokazateli novovvedenij*
Code: OM

e Indifference curve
g Indifferenzkurve
r *Bezrazlichija, funkcija*
Code: @

e Industrial Structure - Indicators
g Kennziffern der Industriestruktur
r *Pokazateli struktury promyshlennosti*
Code: OM

e Industry
g Industrie
Branche
r *Industrija*
otrasl 'narodnogo xozjajstva
Code: @

e Infant Industry
g Entstehender Industriezweig
r *Voznikajushchaja pron-*
nyshlennost'
Code: OM

e Innovation
g Innovation
Neuerung
r *Novovvedenie*
Innovacija
Code: OM

e Innovation decisions
g Innovationsentscheidungen
r *Innovacionnye reshenija*
Code: OM

e Innovation policy
g Innovationspolitik
r *Politika innovacij*
Code: OM

e Innovation potential
g Innovationspotential
Neuerungspotential
r *Innovacionnij potential*
Code: @

e Innovation strategy
g Innovationsstrategie
r *Strategija innovacii*
Code: @

e Innovation, Basic
g Innovation, grundlegende
r *Novovvedenie, osnovnoe*
Code: @

e Innovationsmodels
g Innovationsmodelle
r *Modeli innovacija*
Code: @

e Innovative process
g Neuerungsprozess
r *Process novovvedenija*
Code: OM

e Innovatives System
g Innovierendes System,
System, das die Neuerung ein-
fuehrt
r *Sistema realizujushchaja*
novovvedenie
Code: OM

e Integrated technological basis
for a deweloping country
g Integrierte technische Basis
eines Entwicklungslandes
r *Edinaja texnicheskaja baza*
dlja razvivajushchej strany
Code: OM

e Interdependence between pro-
jects
g Wechselseitige Abhaengigkeit
zwischen Projekten
r *Zavisimosti mezhdu proek-*
tami
Code: @

e Intermediate good
g Zwischenerzeugnis
Halbfertigfabrikat
r *Promezhutochnyj produkt*
Code: @

e Intermediate Technology
g Zwischentechnik
mittlere Technik
r *Srednaja texnika*
Code: @

e Intuition
g Intuition
r *Intuicija*
Code: @

e Invention
g Erfindung
r *Izobretenie*
Code: OM

e Investment control
investment steering
g Investitionslenkung
r *Upravlenie kapitalovlozheni-*
jami
Code: @

e Investment incentive
g Investitionsanreiz
r *Stimul dlja kapitalovloshenija*
Code: @

e Investment, Expansionary
g Investitionen zur Erweiterung
der Produktion
r *Investicii dlja rasshirenija*
proizvodstva
Code: @

e Irreversibility
g Irreversibilitaet
r *Neobratimost'*
Code: SP

e Job shortage
g Arbeitsplatzmangel
r *Nexvatka rabochix mest*
>> Job vacancy
Code: @

e Judgment
g Urteil
Ansicht
r *Mnenie*
ocenka
Code: @

e Key industry
g Schluesselindustrie
r *Kljuchevaja promyshlennost'*
Code: @

e Key technology
g Schluesseltechnologie
r *Kljuchevaja texnologija*
Code: @

e Know how
g Erfahrung
Anwendungswissen
r *No- xou*
Code: SP

e Labor displacement
g Freisetzung von
Arbeitskraeften
r *Vysvobozhdenie rabochix sil*
Code: @

e Labor force
g Erwerbsbevoelkerung
arbeitsfaehige Bevoelkerung
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g Auslastungsgrad
e Degree of utilization
r *Stepen' izpol'zovanija*
Code: @

g Auslaufstadium
e Abandonment stage
r *Faza okonchanija proizvodstva*
Code: OM

g Auswahl
e Choice
r *Vybor*
Code: @

g Auswirkung
e Impact
r *Posledstvie*
Code: SP

g Barrieren der Kreativitaet
e Obstacles to Creativity
r *Prepjatstvija dlja tvorchestva*
Code: OM

g Basisinnovation
Technik
e Basic Innovation
r *Fundamental'naja innovacija revoljucionnoe izmenenie texniki*
> Classification of innovations
Historical taxonomy of innovations
Code: @

g Basislinie,
Bezugslinie
e Baseline
r *Basisnaja linija*
Code: SP

g Bearbeitungsprozess
Prozedur
e Procedure
r *Process dejstvija*
Procedura
Code: OM

g Bedingung
e Condition
r *Uslovie*
Code: OM

g Bedingung, hinreichende
e Condition, sufficient
r *Uslovie, dostatochnoe*
Code: OM

g Bedingung, notwendige
e Condition, Necessary
r *Uslovie, neobxodimoe*
Code: OM

g Bedingung, notwendige und
hinreichende
e Condition, necessary and
sufficient
r *Uslovie, neobxodimoe i dostato-*
chnoe
Code: OM

g Beduerfnis
e Need
r *Potrebnost'*
Code: OM

g Befriedigende Loesung
e Satisfying solution
r *Udovletvoritel'noe reshenie*
Code: OM

g Bestand
e Stock
r *Zapas*
Code: @

g Betriebsblindheit
e NIH Not invented here Syn-
drome
r *Professional'noe neveshestvo*
Code: SP

g Betriebskosten
e Operating costs
r *Fabrichnaja sebestoimost'*
Code: OM

g Bewegungszahl
Stroemungsgroesse
e Flow figure
r *Velichina techenija*
Code: @

g Bewertung
e Evaluation
r *Ocenka*
Code: OM

g Bildungskapital
Bildungsfonds
e Human Capital
r *Fondy obrazovanija*
Code: OM

g Biotechnologie
e Biotechnology
r *Biotexnologija*
Code: SP

g Brain drain
e Brain drain
r *Brejn drejn*
Code: @

g Bruttoinlandsprodukt
e Gross domestic product GDP
r *Valovoj nacional'nyj produkt*
Code: @

g Bruttokapitalbildung
e Gross capital formation
r *Obrazovanie valovogo kapitala*
Code: @

g Bruttosozialprodukt
e Gross national product GNP
r *Valovoj nacional'nyi produkt*
Code: @

g Defekt
e Defect
r *Defekt*
>> Gap
Code: OM

g Delphimethode
e Delphi Method
r *Metod Del'fi*
Code: SP

g Deskriptive Modelle der Entscheidungsfindung unter mehrfacher Zielsetzung
e Descriptive models of multiobjective decision making
r *Deskriptivnye modeli reshenija mnogokriterial'nych problem*
Code: @

g Determinanten der Neuerungstaetigkeit in der Industrie
e Determinants of innovative activities in Industrial Organizations
r *Determinanty novovvedencheskoj dejatel'nosti v promyshlennyx organisacijax*
Code: OM

g Diffusion
Verbreitung
e Diffusion
r *Rasprostranenie*
Code: SP

g Direkte Methoden der Entscheidungsfindung unter mehrfacher Zielsetzung
e Direct methods of multiobjective decision making
r *Prjamye metody prinjatija mnogokriterial'nyx reshenij*
Code: @

g Direktive
e Directive
r *Direktiva*
Code: OM

g Diskontierung
e Discounting
r *Diskontirovanie*
Code: SP

g Dominanz
e Dominance
r *Dominirovanie*
Code: @

g Dynamische Effektivitaet
e Dynamic efficiency
r *Dinamicheskaja effektivnost'*
Code: @

g Effektivitaet
e Effectiveness
r *Effektivnost'*
Code: OM

g Effektivitaet
Nutzeffekt
e Efficiency
r *Effektivnost'*
> Effectiveness
>> Efficiency Cycle
Code: @

g Effektivitaetswirkung von Basis- und Verbesserungsinnovationen
e Efficiency impact of basic and improvement innovations
r *Vliyanie krupnych i malen'kich novovvedenij na effektivnost'*
Code: OM

g Effektivitaetszyklus
e Efficiency Cycle
r *Cikl effektivnosti*
Code: OM

g Effizienz der Faktoren, die Neuerungen beeinflussen
e Efficacy of factors, influencing innovations
r *Effektivnost' faktorov, vlijajushchie na novovvedenii*
>> Factors influencing Innovations
Code: OM

g Einfuehrung
Umsetzung
e Implementation
r *Vvedenie*
Code: @

g Einsparung durch Vergroesserung
e Economy of scale
r *Ekonomija za schet uvelichenija*
Code: SP

g Endprodukt
Finalprodukt
e Final good
r *Konechnyj produkt*
Code: @

g Energie
e Energy
r *Energija*
Code: SP

g Energieumwandlung
e Energy conversion
r *Preobrazovanie energii*
Code: SP

g (guenstige) Moeglichkeiten
e Facilities
r *Blagoprijatnye uslovija*
Code: @

g Entropie
e Entropy
r *Entropija*
Code: SP

g Entscheidungsbaum
e Decision Tree
r *Derevo reshenija*
Code: OM

g Entscheidungsfindung unter mehrfacher Zielsetzung
e Multiobjective decision making
r *Prinjatie mnogokriterialnyx reshenij*
Code: @

g Entscheidungsmodelle
e Decision models
r *Modeli prinjatija reshenij*
Code: @

g Entscheidungsregel
e Decision rule
r *Pravilo prinjatija reshenij*
Code: @

g Entscheidungstheorie
e Decision Theory
r *Teorija reshenija*
Code: SP

g Entscheidungsvorbereitung fuer Innovationen
e Decision Support for Innovations
r *Podgotovka reshenij dlja novovvedenija*
Code: OM

g Entstehender Industriezweig
e Infant Industry
r *Voznikajushchaja pronnyshlennost'*
Code: OM

g Entwicklung
e Development
r *Razrabotki*
>> Research
Code: SP

g Entwicklungsstufen der Technik
e Levels of technology
r *Stupeni razvitija texniki*
Code: OM

g Erfahrung
Anwendungswissen
e Know how
r *No- xou*
Code: SP

g Erfindung
e Invention
r *Izobretenie*
Code: OM

g Ergebnisfunktion
Leistungsprofil
e Figure of Merit
r *Itogovaja funkcija*
Code: SP

g Erhebung
Befragung
e Enquiry
Inquiry
r *Opros*
Code:

g Erkundungsforschung
e Exploratory Research
r *Razvedyvatel'noe issledovanie*
> Research, Exploratory
Code: @

g Erkundungsforschung
e Research, Exploratory
r *Razvedyvatel'noe issledovanie*
Code: SP

g Erkundungsprognose
e Exploratory Forecasting
r *Issledovatelskoe prognozirovanie*
> Forecasting, Exploratory
Code: @

g Erkundungsprognose
e Forecasting, exploratory
r *Razvedyvatelnoe prognoziro-vanie*
Code: OM

g Erneuerung
Renovierung
e Renewal
Renovation
r *Obnovlenie*
Renovacija
>> << Innovation
Code: OM

g Ersatz
e Replacement
r *Zameshchenie*
Code: @

g Ertragsquote
e Yield
r *Doxodnost'*
Code: OM

g Erwarteter Nutzen
e Expected value (utility)
r *Ozhidaemaja cennost'*
Ozhidaemaja poleznost'
Code: @

g Erwerbsbevoelkerung
arbeitsfaehige Bevoelkerung
e Labor force
r *Trudosposobnoe naselenie*
Code: @

g Extensive Investitionen
e Expansionary Investment
r *Ekstensivnye kapital'nye vlozhenija*
Code: @

g Extrapolation, prognostische
e Extrapolation in Forecasting
r *Ekstrapoljacija v prognoziro-vanii*
Code: OM

g Faktoren, die Neuerungen beeinflussen
e Factors influencing Innova-tions
r *Faktory, vlijajushchie na novovvedenii*
Code: OM

g Fertigerzeugnis
e Finished good
r *Gotovoe izdelie*
Code: @

g Flaschenhals
Engpass
e Bottleneck
r *Uzkoe mesto*
Code: @

g Flexibilitaet
e Flexibility
r *Izmenchivost'*, *elastichnost'*
Code: @

g Fluss
e Flow
r *Potok*
Code: @

g Flussdiagramm
e Flow chart
r *Diagramma potokov*
Code: @

g Forschung
e Research
r *Issledovanie*
Code: SP

g Forschung, angewandte
e Research, applied
r *Issledovanie, prikladnoe*
Code: SP

g Forschung, gezielte
e Research, mission oriented
r *Issledovanie, celenapravlen-noe*
Code: SP

g Forschung, Grundlagen-
e Research, Basic
r *Issledovanie, osnovnoe*
> Basic Research
Code: SP

g Forschungseinrichtung
e Research establishment
r *Issledovatel'skaja organisacija*
Code: @

g Forschungsleitung
e Research Management
r *Upravlenie issledovatelskoj dejatel'nost'ju*
Code: SP

g Forschungsprogramm
e Research program
r *Issledovatel'skaja programma*
Code: @

g Forschungsprojekt
e Research project
r *Issledovatel'skij projekt*
Code: @

g Fortgeschrittene Technik
e Technology, high
r *Progressivnaja texnika*
Code: SP

g Freie Marktwirtschaft
e Free-market economy
r *Rynochnaja ekonomika*
Code: @

g Freisetzung von Arbeitskraeften
e Labor displacement
r *Vysvobozhdenie rabochix sil*
Code: @

g Fuehrung
e Leadership
r *Pervenstvo lidirujushchee polozhenie*
Code: @

g Funktion
Aufgabe
e Mission
r *Funkcija*
Zadacha
Code: SP

g Funktionale Substitution
e Substitution, Functional
r *Funkcional'noe zameshchenie*
Code: SP

g Funktionen der Neuerung in einem System
e Functions of Innovations in a System
r *Funkcii novovvedenija v sisteme*
> Classification of Innovations
Code: @

g Gemeinkosten
e Overheads
overhead costs
r *Nakladnye rasxody*
Code: @

g Genesis neuer Techniken
e Genesis of new technologies
r *Genesis novoj texniki*
Code: OM

g Geplante Veraltung
e Planned obsolescence
r *Planirovannoe ustarenie*
Code: OM

g Geschlossene Stoffkreislauefe
e Recycling
r *Zamknutij material'nyj cikl*
Code: SP

g Geschlossener Kreislauf
e Closed cycle
r *Zakrytij krugovorot*
Code: SP

g Gesellschaftliche Verflechtung von Innovationen
e Social interdependence of innovations
r *Social'naja vzaimozavisimost' novovvedenij*
Code: OM

g Gesellschaftliches Lernen
e Societal Learning
r *Obshchestvennoe uchenie*
Code: OM

g Gesetz vom abnehmenden Ertrag
e Law of diminishing returns
r *Zakon umen'shajushchego doxoda*
Code: @

g Gewinnschwelle
Kostenschwelle
e Breakeven point
r *Porog effektivnosti*
Code: OM

g Gleichgewicht
e Equilibrium
r *Ravnovesie*
Code: @

g Globale Wirkungen
e Global effects
r *Global'nye posledstvija*
>> Goal
Code: SP

g Groessenertraege
e Returns to Scale
r *Doxody s masshtaba proizvodstva*
Code: OM

g Grossforschung
e Big Science
r *Bol'shaja nauka*
Code: @

g Grundlagenforschung
e Basic research
r *Fundamental'noe issledovanie*
> Basic research
Code: @

g Grundlagenforschung
e Fundamental Research
r *Fundamental'noe issledovanie*
> Research Fundamental
Code: @

g Grundlagenforschung
e Research, Fundamental
r *Fundamental'noe issledovanie*
Code: SP

g Gruppenentscheidungsfindung
e Group decision making
r *Gruppovoe prinjatie reshenii*
Code: @

g Hardware
e Hardware
r *Xardvejr*
Code: SP

g Harmonisierung
e Harmonization
r *Garmonizacija*
Code: @

g Heuristik
e Heuristic
r *Evristika*
Code: OM

g Heuristische Problemloesung
e Heuristic problem solving
r *Evristicheskoe reshenie problem*
Code: @

g Heuristischer Algorithmus
e Heuristic Algorithm
r *Evristichnyj algorifm*
> Algorithm, Heuristic
Code: @

g Hierarchiestruktur
e Hierarchical structure
r *Ierarxicheskaja struktura*
Code: OM

g Hintergrund
e Background
r *Fon*
Code: SP

g Historische Taxonomie von Neuerungen
e Historical taxonomy of innovations
r *Istoricheskaja ocenka novovvedenij*
>> classification of innovationsHolistic
Code: OM

g Homoeostasis
e Homeostasis
r *Gomeostasis*
Code: SP

g Hypothese des Antriebs durch die Wissenschaft
e Science Push Hypothesis
r *Gipotesa tolchka naukoj*
Code: OM

g Ideale Loesung
e Ideal point (Solution)
r *Ideal'noe reshenie*
Code: @

g In kleinen Schritten zunehmend
e Incremental
r *Medlenno progressirujushchij*
Code: SP

g Indifferenzkurve
e Indifference curve
r *Bezrazlichija, funkcija*
Code: @

g Industrie
Branche
e Industry
r *Industrija*
otrasl'narodnogo xozjajstva
Code: @

g Ingenieurwesen
e Engineering
r *Inzhenernoe obrazovanie*
Code: SP

g Innovation
Neuerung
e Innovation
r *Novovvedenie*
Innovacija
Code: OM

g Innovation, grundlegende
e Innovation, Basic
r *Novovvedenie, osnovnoe*
Code: @

g Innovationsentscheidungen
e Innovation decisions
r *Innovacionnye reshenija*
Code: OM

g Innovationsfunktionen
(Mathematische)
e Innovation Functions
(Mathematical)
r *Funkcii novovvedenija*
(matematicheskie)
Code: OM

g Innovationsmodelle
e Innovationsmodels
r *Modeli innovacija*
Code: @

g Innovationspolitik
e Innovation policy
r *Politika innovacij*
Code: OM

g Innovationspotential
Neuerungspotential
e Innovation potential
r *Innovacionnij potential*
Code: @

g Innovationsstrategie
e Innovation strategy
r *Strategija innovacii*
Code: @

g Innovierendes System,
System, das die Neuerung einfuehrt
e Innovatives System
r *Sistema realizujushchaja novovvedenie*
Code: OM

g Integrierte technische Basis
eines Entwicklungslandes
e Integrated technological basis
for a deweloping country
r *Edinaja texnicheskaja baza dlja razvivajushchej strany*
Code: OM

g Interdisziplinaere Forschung
e Research, interdisciplinary
r *Interdisciplinarnoe issledovanie*
Code: SP

g Intuition
e Intuition
r *Intuicija*
Code: @

g Investitionen zur Erweiterung
der Produktion
e Investment, Expansionary
r *Investicii dlja rasshirenija proizvodstva*
Code: @

g Investitionsanreiz
e Investment incentive
r *Stimul dlja kapitalovlozhenija*
Code: @

g Investitionslenkung
e Investment control
investment steering
r *Upravlenie kapitalovlozheni-jami*
Code: @

g Irreversibilitaet
e Irreversibility
r *Neobratimost'*
Code: SP

g Kapital,
Fonds
e Capital
r *Kapital, fondy*
Code: @

g Kapitalgueterindustrie,
Herstellung von Produktionsmitteln
e Capital Goods Industry
r *Proizvodstvo sredstv proizvodstva dlja proizvodstva sredstv proizvodstva*
Code: OM

g Kapitalkoeffizient
Fondsintensitaet
e Capital coefficient
capital-output ratio
r *Kapitaloemkost'*
Fondoemkost
Code: OM

g Kapitalproduktivitaet
Produktionseffekt der Fonds
e Productivity of capital stock
r *Proizvodstvennyj effekt fondov*
Code: OM

g Kennzeichen
Merkmal
e Attribute
r *Priznak*
Code: @

g Kennziffern der Industriestruktur
e Industrial Structure - Indicators
r *Pokazateli struktury promyshlennosti*
Code: OM

g Kennziffern von Innovationen
e Indicators of innovations
r *Pokazateli novovvedenij*
Code: OM

g Klassifizierung von Innovationen
e Classification of innovations
r *Klassifikacija novovvedenij*
>> Historical taxonomy of innovations
Code: OM

g Kommunikation
e Communication
r *Kommunikacija*
Code: SP

g Komplex, agro/industrieller
e Complex, agro-industrial
r *Kompleks, agravno-promyshlennyi*
> Agro-Industrial Complex
Code: @

g Komplexitaet der Neuerungsprozesse
e Complexity of innovations
r *Kompleksnost' novovvedenij*
Code: OM

g Konkurrenz
Wettbewerb
e Competition
r *Konkurencija*
sorevnovanie
Code: @

g Kosten-Nutzen-Analyse
e Cost-Benefit Analysis
r *Analiz zatrat i rezul'tatov*
>> Risk/ Benefit Analysis
Code: SP

g Kreativitaet
Schoepfertum
e Creativity
r *tvorchestvo*
Code: OM

g Kreativitaet und Routineerfahrung
e Creativity and routine experience
r *Tvorchestvo i rutinnyj opyt*
Code: OM

g Kreativitaetskennziffern
e Creativity indicators
r *Pokazateli tvorchestva*
Code: OM

g Kriterium
e Criterion
r *Kriterij*
Code: SP

g Kriterium
Ziel
e Objective (noun)
r *Kriterij*
cel'
Code: SP

g Land- und Nahrungsgueterwirtschafts-Komplex
e Agro-industrial complex
r *Agrarno- promyshlennyj kompleks*
Code: SP

g Lebenszyklus
e Life cycle
r *Zhiznennij cikl*
Code: @

g Leistungsprinzip
e Performance principle
r *Princip oplaty po trudu*
Code: @

g Leitungsausnahmeprinzip
e Management by exception
r *Upravlenie po iskljuchenijam*
Code: @

g Leitungsinformationssysteme
e Management information systems
r *Informacionnye sistemy upravlenija*
Code: @

g Lernkurve
e Learning corve
r *Krivaja obuchenija*
Code: @

g Lizenz
amtliche Erlaubnis
e Licence
r *Licensija*
Code: @

g Loesung, befriedigende
e Solution, satisfying
r *Reshenie, udovletvoritel'noe*
> Satisfying Solution
Code: @

g Luecke
e Gap
r *Otstavanie*
Code: @

g Marktstruktur
e Market structure
r *Struktura rynka*
Code: @

g Masstheorie
e Measurement theory
r *Teorija izmerenij*
Code: @

g Material
e Material
r *Materialy*
Code: SP

g Materialkreislauf
e Materials Cycle
r *Cikl materialov*
Code: SP

g Materialwirtschaft
e Materials Management
r *Material'noe xozjajstvo*
Code: SP

g Materiell-technische Basis
e Material-technical basis
r *Material'no- texnicheskaja basa*
Code: @

g Mathematische Programmierungsmodelle
e Mathematical programming models
r *Modell matematicheskogo programmirovanija*
Code: @

g Mehrfache Kriterien
e Multiple criteria
r *Mnogie kriterii*
Code: @

g Mensch-Maschine Dialog
e Man-machine dialogue
r *Cheloveko- mashinnyi dialog*
Code: @

g Methode der Bezugspunkte
e Reference point approach
r *Metod punktov otpravlenija*
Code: @

g Methode des kritischen Weges
e Critical path method
r *Metod kriticheskogo puti*
Code: @

g Mittel
e Means
r *Sredstva*
Code: OM

g Modell
e Model
r *Model*
Code: SP

g Modelle der Effektivitaetsgrenze
e Frontier Models
r *Modeli predel'noj effektivnosti*
Code: @

g Modelle der Risikoanalyse
e Risk Analysis Models
r *Modeli analiza riska*
Code: @

g Modellrechnung
e Model calculation
r *Ischislenie modeli*
Code: @

g Modernisierung
Rekonstruktion
e Modernization
r *Rekonstrukcija*
Code: OM

g Moeglichkeit
e Possibility
r *Vozmozhnost'*
Code: OM

g Monte Carlo-Techniken
e Monte Carlo techniques
r *Metody Monte Karlo*
Code: @

g Moralischer Verschleiss
Veraltung
e Obselescence
r *Moral'nyj iznos*
Ustarenie
Code: OM

g Morphologische Analyse
e Morphological analysis
r *Morfologicheskij analiz*
Code: OM

g Multinationale Konzerne
e Multinational Corporations
r *Multinacionalnye korporacii*
Code: SP

g Multiplikative Nutzensfunktionen
e Multiplicative utility functions
r *Multiplikativnye funkcii poleznosti*
Code: @

g Nachfrage
Bedarf
e Demand
r *Spros*
potrebnost'
Code: @

g Nachfragehypothese
Beduerfnisdruckhypothese
e Demand Pull Hypothesis
r *Gipotesa prisasyvanija sprosom*
gipotesa prisasyvanija potrebnostju
>> Science Push Hypothesis
Code: OM

g Nahrungsmittelkette
e Food Chain
r *Prodovolstvennaja cepochka*
Code: SP

g Nationalreichtum
e National wealth
r *Nacional'noe bogatstvo*
Code: OM

g Naturressourcen
e Natural Resource
r *Estestvennyj resurs*
Code: OM

g Nebenwirkungen
e Side Effects
r *Postoronnye posledstvija*
Code: SP

g Nettoenergie-Analyse
e Net Energy Analysis
r *Analis chistoj energii*
Code: SP

g Nettowert
e Net value
r *Chistaja stoimost'*
Code: @

g Neuerung
e Novation
r *Novacija*
> Innovation
Code: @

g Neuerungsprozess
e Innovative process
r *Process novovvedenija*
Code: OM

g Neuheit
e Novelty
r *Novshestvo*
Code: @

g Norm
e Norm
r *Norm*
Code: SP

g Normativ
e Normative
r *Normativnyj*
Code: SP

g Normative Modelle der Entscheidungsfindung unter mehrfacher Zielsetzung
e Normative models of multiobjective decusion making
r *Normativnye modeli reshenija mnogokriterial'nych problem*
Code: @

g Normative Prognose
e Normative Forecasting
r *Normativnyj prognoz*
Code: @

g Nutzen, Vorteil
e Benefit
r *Pol'za vygoda*
Code: @

g Nutzen-Kosten-Analyse
e Benefit/Cost Analysis
r *Analiz resul'tatov i zatrat*
> Cost/Benefit Analysis
Code: @

g Nutzen-Risiko-Analyse
e Benefit/Risk Analysis
r *Analiz pol'zy i riska*
> Risk/Benefit Analysis
Code: @

g Nutzeneinschaetzung
e Utility assessment
r *Ocenka poleznosti*
Code: @

g Nutzensabhaengigkeit
e Utility dependence
r *Zavisimost' po poleznosti*
Code: @

g Nutzensfunktion
e Utility function
r *Funkcija poleznosti*
Code: @

g Nutzensfunktion
e Value function
r *Funkcija pol'zy*
Code: @

g Nutzenstheorie
e Utiliy theory
r *Teorija poleznosti*
Code: @

g Nutzenunabhaengigkeit
e Utility-independent
r *Nezavisimyj po poleznosti*
Code: @

g Oekistik
e Ekistics
r *Ekistika*
Code: SP

g Oekosystem
e Ecosystem
r *Ekosistema*
Code: SP

g Operationale Umwelt
e Operational environment
r *Operacional'noe okruzhenie*
Code: @

g Option
Wahlmoeglichkeit
e Option
r *Vozmozhnost' vybora*
Code: SP

g Paradigma
e Paradigm
r *Paradigm*
Code: SP

g Parameter
e Parameter
r *Parameter*
Code: SP

g Periode eines Zyklus
e Period of a cycle
r *Period cikla*
Code: OM

g Peudoinnovation
Scheininnovation
e Pseudo Innovation
r *Psevdoinnovacija*
Code: OM

g Phase des schnellen Wachstums
e Rapid growth stage
r *Fasa bystrogo rosta*
Code: @

g Phasen des Innovationsprozesses und Stufen des Entscheidungsprozesses
e Phases of the innovation process and stages of the decision process
r *Fazy processa novovvedenija i etapy processa reshenija*
Code: OM

g Phasenverschiebung zwischen zwei Zeitreihen
e Lead - lag relationship
r *Fasovyj lag mezhdu dvumja vremennymi rjadami*
Code: @

g Politik
e Policy
r *Politika*
Code: SP

g Praeferenz
e Preference
r *Predpochtenie*
Code: @

g Prioritaeten
e Priorities
r *Prioritety*
Code: SP

g Probabilistische Situation
e Probabilistic situation
r *Verojatnostnaja situacija*
Code: OM

g Problem
e Problem
r *Problema*
Code: OM

g Produktauswahl
e Product selection process
r *Process vybora izdelij*
Code: @

g Produktinnovation
Erzeugnisneuerung
e Product Innovation
r *Novovvedenie izdelij*
Code: @

g Produktionsablauf - Innovation
Neuerung im Herstellungsprozess
e Manufacturing Innovation
r *Novovvedenie b processe proizvodstva*
Code: OM

g Produktionsfaktor
e Factor of Production
r *Faktor proizvodstva*
Code: OM

g Produktionsmassstab
e Scale of production
r *Masshtab proizvodstva*
Code: @

g Produktionsmittel
e Means of production
r *Sredstva proizvodstva*
Code: @

g Produktivitaetswachstum und Innovation
e Productivity grouth and innovation
r *Rost proizvoditel'nosti i novovvedenie*
Code: OM

g Profitrate
Rentabilitaetsrate
e Rate of return
r *Pribyl'nost'*
Rentabel'nost'
Code: OM

g Prognose
Vorausberechnung
e Forecast
r *Prognoz*
Code: SP

g Prognose, normative
e Forecasting, Normative
r *Prognozirovanie, normativnoe*
Code: OM

g Prognosemethoden - Grundbegriffe
e Forecasting Methods-basic terms
r *Metody prognozirovanija - osnovnye ponjatija*
Code: OM

g Progressive Energietechnologien
e Advanced Energy Technologies
r *Progressivnye energeticheskie texnologii*
>> Alternative Energy or Exotic Energy
Code: SP

g Projektbewertung
e Project evaluation
r *Ocenka proekta*
Code: @

g Projektleitung
e Project management
r *Upravlenie proektom*
Code: @

g Prozedurale Innovation
e Procedural Innovation
r *Procedural'noe novovvedenie*
Code: @

g Prozessinnovation
Verfahrensneuerung
e Process Innovation
r *Texnologicheskoe novovvedenie*
Code: @

g Querschnittsanalyse
e Cross-section analysis
r *Analiz po poperechnomu razrezu*
Code: @

g Rationalisierung
e Rationalization
r *Racionalizacija*
Code: OM

g Rationalisierungsinvestitionen
intensive Investitionen
e Rationalization Investment
r *Intensivnye kapital'nye vlozhenija*
Code: @

g Regeln der Zusammenfassung
e Composition rules
r *Pravila sinteza*
Code: @

g Reifephase
e Maturation stage
r *Faza zrelosti*
Code: @

g Reine Forschung
e Research, Pure
r *Chistoe issledovanie*
Code: SP

g Relative Effektivitaet
e Relative efficiency
r *Otnositel'naja effektivnost'*
>> Efficiency Cycle
Code: OM

g Rentabilitaetsrate
Profitrate
e Profit margin
r *Pribyl'nost'*
Code: OM

g Reproduktion
e Reproduction
r *Vozproizvodstvo*
Code: OM

g Ressourcen
e Resources
r *Resurcy*
Code:

g Ressourcenoekonomie
e Conservation of resources
r *Ekonomija resursov*
Code: SP

g Restriktion, Nebenbedingung
e Constraint
r *Ogranichenie*
Code: SP

g Risiko
e Risk
r *Risk*
Code: @

g Risiko-Analyse
e Risk Analysis
r *Analiz riska*
Code: SP

g Risiko-Nutzen-Analyse
e Risk / Benefit Analysis
r *Risk- Pol'za- Analiz*
Code: SP

g Risikoabneigung
e Risk aversion
r *Sklonnost' protiv riska*
Code: @

g Rohmaterial
e Raw material
r *Syr'e*
Code: OM

g Routineerfahrung
Routinewissen
e Routine knowledge
knowledge from experience
r *Rutinnyj opyt*
routinnoe znanie
Code: @

g Rueckkopplung
e Feedback
r *Obratnaja svjaz'*
Code: SP

g S-Kurve
e S-curve
r *S- Krivaja*
Code: SP

g Saettigungsphase
e Saturation stage
r *Fasa nasyshchenija*
Code: @

g Schaetzung von Wahrscheinlichkeiten
e Probability assessment
r *Ocenka verojatnosti*
Code: @

g Schluesselindustrie
e Key industry
r *Kljuchevaja promyshlennost'*
Code: @

g Schluesseltechnologie
e Key technology
r *Kljuchevaja texnologija*
Code: @

g Schwellwert
e Threshold
r *Porog*
Code: SP

g Schwerindustrie
e Heavy industry
r *Tjazholaja promyshlennost'*
Code: @

g Sekundaereffekte
e Second-Order-Effects
r *Vtorichnye effekty*
> Side Effects
Code: @

g Serendipitaet
e Serendipity
r *Serendipnost'*
Code: SP

g Software
e Software
r *Softveir*
Code: SP

g Sozialoekonomische Moeglichkeiten
e Socio-economic opportunities
r *Social'no- ekonomicheskie vozmozhnosti*
> socio-economic opportunity analysis
Code: @

g Sozialoekonomische Opportunitaetsanalyse
e Socio-economic opportunity analusis
r *Analiz social'no-ekonomicheskix vozmozhnostej*
Code: OM

g Sozialprodukt
e National product
r *Nacionalnyj produkt*
Code: @

g Spieltheorie
e Game Theory
r *Teorija igr*
Code: SP

g Spin-off
e Spin-off
r *Spin- off*
Code: SP

g Stabiler Zustand
e Steady State
r *Ustojchivoe sostojanie*
Code: SP

g Starkstrukturierte Probleme
e Well-structured problems
r *Xorosho- strukturizovannye problemy*
Code: @

g Startphase
Einfuehrungsphase
e Take-off stage
implementation stage
r *Faza vnedrenija*
Code: @

g Strategie
e Strategy
r *Strategija*
Code: SP

g Strategische Planung
e Strategic planning
r *Strategicheskoe planirovanie*
Code: @

g Struktur der Innovation
e Structure of innovation
r *Struktura novovvedenija*
Code: @

g Strukturwandel
e Structural change
r *Strukturnoe izmenenie*
Code: @

g Subjektive Wahrscheinlichkeit
e Subjective probability
r *Sub''ektivnaja verojatnost'*
Code: @

g Substitution
e Substitution
r *Zameshchenie*
Code: SP

g Synergistische Effekte
e Synergistic Effects
r *Sinergisticheskie effekty*
Code: OM

g System dynamics
e System dynamics
r *Sistemnaja dinamika*
Code: @

g Szenarium
e Scenario
r *Scenario*
Code: SP

g Taxonomie von Neuerungen
e Taxonomy of innovations
r *Ocenka novovvedenij*
> Historical Taxonomy of innovation
Code: @

g Technik
e Technique
r *Texnika*
>> Technology
Code: SP

g Technik fuer die Infrastruktur
e Technology, Public
r *Texnika dlja infrastruktury*
Code: SP

g Technikanwendung
e Technology utilization
r *Izpol'zovanie texniki*
Code: SP

g Technikfolgenabschaetzung
Technikbewertung
e Technology assessment
r *Ocenka texnologii*
>> Socio-economic opportunity analysis
Code: SP

g Technische Politik
e Technology policy
r *Texnicheskaja politika*
Code: @

g Technische Revolutionen
e Technical revolutions
r *Texnicheskie revoljucii*
Code: OM

g Technische Veraltung
e Technological obsolescence
r *Texnicheskoe ustarenie*
Code: SP

g Technologie
Technik
e Technology
r *Texnologija*
Code: SP

g Technologie, angepasste
e Technology, appropriate
r *Texnologija, podxodjashchaja*
> Appropriate Technology
Code: @

g Technologietransfer
e Technology Transfer
r *Transfer texniki nauchno- texnicheskij obmen*
Code: SP

g Technologische Luecke
e Technology Gap
r *Nauchnotexnicheskoe otstavanie*
Code: sP

g Technologischer Verarbeitungzyklus
gesellschaftlicher Produktionsprozess
e Resource processing system
r *Obshchestvennaja texnologija texnologicheskij cikl*
Code: @

g Time sharing Coumputersystem
e Time sharing computer system
r *Elektronno- vychislitel'naja mashina s razdeleniem vremeni*
Code: @

g Typen von Neuerungsprozessen
e Types of Innovations
r *Tipy novovvedenij*
> Classification of innovations
Code: @

g Ueberleitung in die Produktion
e Implementation into production
r *Osvoenie na proizvodstva*
Code: @

g Umwelt
Umgebung
e Environment
r *Okrushajushchaja sreda*
Code: SP

g Unbestimmte Menge
e Fuzzy set
r *Razmytoe mnozhestvo*
Code: @

g Unerledigter Auftragsbestand
e Backlog of unfilled orders
r *Zapas nevypolnennych zakazov*
Code: OM

g Ungleichgewicht
e Disequilibrium
imbalance
r *Neravnovesie*
Code:

g Ungleichgewicht
Unausgeglichenheit
e Maladjustment
disequilibrium
r *Neravnovesie neuravnoveshennost'*
Code: @

g Unsicherheit
Unbestimmtheit
e Uncertainty
r *Neopredelonnost'*
Code: @

g Unternehmensfuehrung
Unternehmensleitung
e Entrepreneurship
r *Predprinimatelstvo*
Code: @

g Unternehmer
e Entrepreneur
r *Predprinimatel'*
Code: @

g Unternehmung
Unternehmen
e Enterprise
r *Firma*
Code:

g Urteil
Ansicht
e Judgment
r *Mnenie*
ocenka
Code: @

g Variante
e Variant
r *Varijant*
> Alternative
Code: @

g Verbesserungsinnovation
evolutionaere Neuerung
e Improvement Innovation
r *Evoljucionnoe izmenenie tekniki*
> Classification of Innovations
Code: @

g Vereinigung
Zusammenschluss
e Merger
r *Ob"edinenie*
> Amalgamation
Code: @

g Verkauf
e Lead
r *Operezhenie*
Code: @

g Verluste
e Losses
r *Poteri*
Code: @

g Verteilung von Ressourcen
e Allocation of resources
r *Raspredelenie resursov*
Code: OM

g Voraussage
e Prediction
r *Predskazyvanie*
Code: SP

g Vorlaufzeit
e Lead Time
r *Vremja operezhenija*
Code: SP

g Vorstudie, in der Moeglichkeiten und Alternativen abgeklaert werden
e Feasibility study
r *Predvaritel'noe izuchenie realizuemosti*
Code: @

g Wachstumsindustrie
e Growth industry
r *Rastushchaja otrasl' promyshlennosti*
Code: @

g Wachstumspolitik
e Growth policy
r *Politika rosta*
Code: @

g Wachstumsrate
e Growth rate
r *Temp rosta*
Code: @

g Wachstumsziel
e Growth target
r *Cel' rosta*
Code: @

g Wechselseitige Abhaengigkeit zwischen Projekten
e Interdependence between projects
r *Zavisimosti mezhdu proektami*
Code: @

g Wert
e Value
r *Stoimost'*
cennost'
Code: @

g Widerspruch
Dilemma
e Trade-off
r *Protivorechie*
otnoshenie obratnoj zavisimosti
Code: SP

g Wirkungsgrad, technischer
e Efficacy, technical
r *Koefficient poleznogo dejstvija, texnicheskij*
> Effectiveness
Code: @

g Wirtschaftsbereich
Wirtschaftsektor
e Economic division
r *Narodno- xozjajstvennaja otrasl'*
Code: @

g Wirtschaftskennzahlen
e Economic indicators
r *Ekonomicheskie pokazateli*
Code: SP

g Wissenschaft
e Science
r *Nauka*
Code: SP

g Wissenschaftlich-technische Prognose
e Technology Forecasting
r *Nauchno- texnicheskoe prognozirovanie*
Code: SP

g Wissenschaftlich-technischer Antrieb
e Technology push
r *Tolchok so storony texnologii*
Code: @

g Wissenschaftlich-technischer Fortschritt
technischer Wandel
e Technological change
r *Nauchno- texnicheskij progress*
Code: @

g Wissenschaftlich-technischer Rueckstand
e Technological Lag
r *Nauchno- texnicheskoe otstojanie*
Code: SP

g Wissenschaftliche Arbeitsorganisation
e Management Engineering
r *Nauchnaja organisacija truda*
Code: SP

g Wissenschaftspolitik
e Science policy
r *Nauchnaja politika*
Code: SP

g Zeithorizont
e Time horizon
r *Vremennoj gorizont*
Code: @

g Zeitpraeferenz
e Time preference
r *Predpochtenie po vremeni*
Code: @

g Zeitraum fuer den Ausgleich des Produktivitaetsniveaus in zwei Laendern
e Time needed for equalization of productivity lewel in two countries
r *Vremja vyravnivanija urovnja proizvoditel'nosti v dvux stranax*
Code: OM

g Zeitverzoegerung
e Lag
r *Lag*
Code: @

g Ziele, nationale
e Goals, national
r *Celi, nacional'nye*
Code: @

g Zielorientierte Leitung
e Management by Objectives
r *Upravlenie po celjam*
Code: SP

g Zielprogrammierung
e Goal programming
r *Celevoe programmirovanie*
Code: @

g Zitatenanalyse
e Citation Analysis
r *Analiz citatov*
Code: SP

g Zukunftsforschung
e Futures Research
r *Issledovanie budushchego*
Code: SP

g Zusammenschluss
Fusion
e Amalgamation,
merger
r *Soedinenie*
ob"edinenie
Code: @

g Zustand
e State of the Art
r *Polozhenie*
Code: SP

g Zwischenerzeugnis
Halbfertigfabrikat
e Intermediate good
r *Promezhutochnyj produkt*
Code: @

g Zwischenmenschliche Beziehungen
e Human relations
r *Mezhchelovecheskie otnoshenija*
Code: @

g Zwischentechnik
mittlere Technik
e Intermediate Technology
r *Srednaja texnika*
Code: @

g Zwischentechnik
mittlere Technik
e Technology, intermediate
r *Srednaja texnika*
>> Appropriate Technology
Code: SP

Russian Index

r *Agrarno- promyshlennyj kompleks*
e Agro-industrial complex
g Land- und Nahrungsgueterwirtschafts-Komplex
Code: SP

r *Algorifm*
e Algorithm
g Algorithmus
Code: OM

r *Algorifm, evristichnyj*
e Algorithm, heuristic
g Algorithmus, heuristischer
Code: OM

r *Al'ternativa*
e Alternative
g Alternative
Code: OM

r *Analiz zatrat/effektivnosti*
e Cost/effectiveness analysis
g Aufwands-Effektivitaetsanalyse
Code: SP

r *Analiz zatrat i rezul'tatov*
e Cost-Benefit Analysis
g Kosten-Nutzen-Analyse
>> Risk/ Benefit Analysis
Code: SP

r *Analiz matricy vzaimnogo vlijanija*
e Cross Impact Matrix Analysis
g Analyse der Krenzbeeinflussungsmatrix
Code: SP

r *Analiz po poperechnomu razrezu*
e Cross-section analysis
g Querschnittsanalyse
Code: @

r *Analiz pol'zy i riska*
e Benefit/Risk Analysis
g Nutzen-Risiko-Analyse
> Risk/Benefit Analysis
Code: @

r *Analiz resul'tatov i zatrat*
e Benefit/Cost Analysis
g Nutzen-Kosten-Analyse
> Cost/Benefit Analysis
Code: @

r *Analiz reshenij*
e Decision Analysis
g Analyse von Entscheidungen
Code: @

r *Analiz riska*
e Risk Analysis
g Risiko-Analyse
Code: SP

r *Analiz social'no-ekonomicheskix vozmozhnostej*
e Socio-economic opportunity analusis
g Sozialoekonomische Opportunitaetsanalyse
Code: OM

r *Analiz citatov*
e Citation Analysis
g Zitatenanalyse
Code: SP

r *Analizis*
e Analysis
g Analyse
Code: SP

r *Analis chistoj energii*
e Net Energy Analysis
g Nettoenergie-Analyse
Code: SP

r *Basisnaja linija*
e Baseline
g Basislinie, Bezugslinie
Code: SP

r *Bezrazlichija, funkcija*
e Indifference curve
g Indifferenzkurve
Code: @

r *Biotexnologija*
e Biotechnology
g Biotechnologie
Code: SP

r *Blagoprijatnye uslovija*
e Facilities
g (guenstige) Moeglichkeiten
Code: @

r *Bol'shaja nauka*
e Big Science
g Grossforschung
Code: @

r *Brejn drejn*
e Brain drain
g Brain drain
Code: @

r *Valovoj nacional'nyi produkt*
e Gross national product GNP
g Bruttosozialprodukt
Code: @

r *Valovoj nacional'nyj produkt*
e Gross domestic product GDP
g Bruttoinlandsprodukt
Code: @

r *Varijant*
e Variant
g Variante
> Alternative
Code: @

r *Vvedenie*
e Implementation
g Einfuehrung Umsetzung
Code: @

r *Velichina techenija*
e Flow figure
g Bewegungszahl
Stroemungsgroesse
Code: @

r *Verojatnostnaja situacija*
e Probabilistic situation
g Probabilistische Situation
Code: OM

r *Vliyanie krupnych i malen'kich novovvedenij na effektivnost'*
e Efficiency impact of basic and improvement innovations
g Effektivitaetswirkung von Basis- und Verbesserungsinnovationen
Code: OM

r *Vneshnie effkti*
e Externalities
g Aeussere Effekte
Code: SP

r *Vozmozhnost'*
e Possibility
g Moeglichkeit
Code: OM

r *Vozmozhnost' vybora*
e Option
g Option
Wahlmoeglichkeit
Code: SP

r *Voznikajushchaja pronnyshlennost'*
e Infant Industry
g Entstehender Industriezweig
Code: OM

r *Vozproizvodstvo*
e Reproduction
g Reproduktion
Code: OM

r *Vremennoj gorizont*
e Time horizon
g Zeithorizont
Code: @

r *Vremja vyravnivanija urovnja proizvoditel'nosti v dvux stranax*
e Time needed for equalization of productivity lewel in two countries
g Zeitraum fuer den Ausgleich des Produktivitaetsniveaus in zwei Laendern
Code: OM

r *Vremja operezhenija*
e Lead Time
g Vorlaufzeit
Code: SP

r *Vtorichnye effekty*
e Second-Order-Effects
g Sekundaereffekte
> Side Effects
Code: @

r *Vybor*
e Choice
g Auswahl
Code: @

r *Vysvobozhdenie rabochix sil*
e Labor displacement
g Freisetzung von Arbeitskraeften
Code: @

r *Garmonizacija*
e Harmonization
g Harmonisierung
Code: @

r *Genesis novoj texniki*
e Genesis of new technologies
g Genesis neuer Techniken
Code: OM

r *Gipotesa prisasyvanija sprosom*
gipotesa prisasyvanija potrebnostju
e Demand Pull Hypothesis
g Nachfragehypothese
Beduerfnisdruckhypothese
>> Science Push Hypothesis
Code: OM

r *Gipotesa tolchka naukoj*
e Science Push Hypothesis
g Hypothese des Antriebs durch die Wissenschaft
Code: OM

r *Global'nye posledstvija*
e Global effects
g Globale Wirkungen
>> Goal
Code: SP

r *Gomeostasis*
e Homeostasis
g Homoeostasis
Code: SP

r *Gotovoe izdelie*
e Finished good
g Fertigerzeugnis
Code: @

r *Gruppovoe prinjatie reshenii*
e Group decision making
g Gruppenentscheidungsfindung
Code: @

r *Determinanty novovvedencheskoj dejatel'nosti v promyshlennyx organisacijax*
e Determinants of innovative activities in Industrial Organizations
g Determinanten der Neuerungstaetigkeit in der Industrie
Code: OM

r *Derevo reshenija*
e Decision Tree
g Entscheidungsbaum
Code: OM

r *Deskriptivnye modeli reshenija mnogokriterial'nych problem*
e Descriptive models of multiobjective decision making
g Deskriptive Modelle der Entscheidungsfindung unter mehrfacher Zielsetzung
Code: @

r *Defekt*
e Defect
g Defekt
>> Gap
Code: OM

r *Diagramma potokov*
e Flow chart
g Flussdiagramm
Code: @

r *Dinamicheskaja effektivnost'*
e Dynamic efficiency
g Dynamische Effektivitaet
Code: @

r *Direktiva*
e Directive
g Direktive
Code: OM

r *Diskontirovanie*
e Discounting
g Diskontierung
Code: SP

r *Dominirovanie*
e Dominance
g Dominanz
Code: @

r *Doxodnost'*
e Yield
g Ertragsquote
Code: OM

r *Doxody s masshtaba proizvodstva*
e Returns to Scale
g Groessenertraege
Code: OM

r *Evoljucionnoe izmenenie texniki*
e Improvement Innovation
g Verbesserungsinnovation
evolutionaere Neuerung
> Classification of Innovations
Code: @

r *Evristika*
e Heuristic
g Heuristik
Code: OM

r *Evristicheskoe reshenie problem*
e Heuristic problem solving
g Heuristische Problemloesung
Code: @

r *Evristichnyj algorifm*
e Heuristic Algorithm
g Heuristischer Algorithmus
> Algorithm, Heuristic
Code: @

r *Edinaja texnicheskaja baza dlja razvivajushchej strany*
e Integrated technological basis for a deweloping country
g Integrierte technische Basis eines Entwicklungslandes
Code: OM

r *Ekistika*
e Ekistics
g Oekistik
Code: SP

r *Ekonomicheskie pokazateli*
e Economic indicators
g Wirtschaftskennzahlen
Code: SP

r *Ekonomija za schet uvelichenija*
e Economy of scale
g Einsparung durch Vergroesserung
Code: SP

r *Ekonomija resursov*
e Conservation of resources
g Ressourcenoekonomie
Code: SP

r *Ekosistema*
e Ecosystem
g Oekosystem
Code: SP

r *Ekstensivnye kapital'nye vloshenija*
e Expansionary Investment
g Extensive Investitionen
Code: @

r *Ekstrapoljacija v prognozirovanii*
e Extrapolation in Forecasting
g Extrapolation, prognostische
Code: OM

r *Elektronno- vychislitel'naja mashina s razdeleniem vremeni*
e Time sharing computer system
g Time sharing Coumputersystem
Code: @

r *Energija*
e Energy
g Energie
Code: SP

r *Entropija*
e Entropy
g Entropie
Code: SP

r *Estestvennyj resurs*
e Natural Resource
g Naturressourcen
Code: OM

r *Effektivnost'*
e Effectiveness
g Effektivitaet
Code: OM

r *Effektivnost'*
e Efficiency
g Effektivitaet
Nutzeffekt
> Effectiveness
>> Efficiency Cycle
Code: @

r *Effektivnost' faktorov, vlijajushchie na novovvedenii*
e Efficacy of factors, influencing innovations
g Effizienz der Faktoren, die Neuerungen beeinflussen
>> Factors influencing Innovations
Code: OM

r *Zhiznennij cikl*
e Life cycle
g Lebenszyklus
Code: @

r *Zavisimosti mezhdu proektami*
e Interdependence between projects
g Wechselseitige Abhaengigkeit zwischen Projekten
Code: @

r *Zavisimost' po poleznosti*
e Utility dependence
g Nutzensabhaengigkeit
Code: @

r *Zadacha*
e Task
g Aufgabe
>> Problem
Code: OM

r *Zakon umen'shajushchego dohoda*
e Law of diminishing returns
g Gesetz vom abnehmenden Ertrag
Code: @

r *Zakrytij krugovorot*
e Closed cycle
g Geschlossener Kreislauf
Code: SP

r *Zameshchenie*
e Replacement
g Ersatz
Code: @

r *Zameshchenie*
e Substitution
g Substitution
Code: SP

r *Zamknutij material'nyj cikl*
e Recycling
g Geschlossene Stoffkreislauefe
Code: SP

r *Zapas*
e Stock
g Bestand
Code: @

r *Zapas nevypolnennych zakazov*
e Backlog of unfilled orders
g Unerledigter Auftragsbestand
Code: OM

r *Ideal'noe reshenie*
e Ideal point (Solution)
g Ideale Loesung
Code: @

r *Ierarxicheskaja struktura*
e Hierarchical structure
g Hierarchiestruktur
Code: OM

r *Izmenchivost', elastichnost'*
e Flexibility
g Flexibilitaet
Code: @

r *Izobretenie*
e Invention
g Erfindung
Code: OM

r *Izpol'zovanie texniki*
e Technology utilization
g Technikanwendung
Code: SP

r *Imushchestvo*
e Asset
g Aktivposten
Code: OM

r *Investicii dlja rasshirenija proizvodstva*
e Investment, Expansionary
g Investitionen zur Erweiterung der Produktion
Code: @

r *Industrija otrasl'narodnogo xozjajstva*
e Industry
g Industrie
Branche
Code: @

r *Inzhenernoe obrazovanie*
e Engineering
g Ingenieurwesen
Code: SP

r *Innovacionnij potential*
e Innovation potential
g Innovationspotential
Neuerungspotential
Code: @

r *Innovacionnye reshenija*
e Innovation decisions
g Innovationsentscheidungen
Code: OM

r *Instrumenty planivoranija*
e Tools for planning
g Arbeitsinstrumente der Planung
Code: OM

r *Intensivnye kapital'nye vlozhenija*
e Rationalization Investment
g Rationalisierungsinvestitionen
intensive Investitionen
Code: @

r *Interdisciplinarnoe issledovanie*
e Research, interdisciplinary
g Interdisziplinaere Forschung
Code: SP

r *Intuicija*
e Intuition
g Intuition
Code: @

r *Informacionnye sistemy upravlenija*
e Management information systems
g Leitungsinformationssysteme
Code: @

r *Issledovanie*
e Research
g Forschung
Code: SP

r *Issledovanie, osnovnoe*
e Research, Basic
g Forschung, Grundlagen-
> Basic Research
Code: SP

r *Issledovanie, prikladnoe*
e Research, applied
g Forschung, angewandte
Code: SP

r *Issledovanie, celenapravlennoe*
e Research, mission oriented
g Forschung, gezielte
Code: SP

r *Issledovanie budushchego*
e Futures Research
g Zukunftsforschung
Code: SP

r *Issledovatelskoe prognozirovanie*
e Exploratory Forecasting
g Erkundungsprognose
> Forecasting, Exploratory
Code: @

r *Issledovatel'skaja organisacija*
e Research establishment
g Forschungseinrichtung
Code: @

r *Issledovatel'skaja programma*
e Research program
g Forschungsprogramm
Code: @

r *Issledovatel'skij projekt*
e Research project
g Forschungsprojekt
Code: @

r *Istoricheskaja ocenka novovvedenij*
e Historical taxonomy of innovations
g Historische Taxonomie von Neuerungen
>> classification of innovationsHolistic
Code: OM

r *Ischislenie modeli*
e Model calculation
g Modellrechnung
Code: @

r *Itogovaja funkcija*
e Figure of Merit
g Ergebnisfunktion
Leistungsprofil
Code: SP

r *Kapital, fondy*
e Capital
g Kapital, Fonds
Code: @

r *Kapitaloemkost' Fondoemkost*
e Capital coefficient
capital-output ratio
g Kapitalkoeffizient
Fondsintensitaet
Code: OM

r *Kapital'nye vlozhenija v osnovnye fondy*
e Fixed investment
g Anlageinvestitionen
Code: @

r *Klassifikacija novovvedenij*
e Classification of innovations
g Klassifizierung von Innovationen
>> Historical taxonomy of innovations
Code: OM

r *Kljuchevaja promyshlennost'*
e Key industry
g Schluesselindustrie
Code: @

r *Kljuchevaja texnologija*
e Key technology
g Schluesseltechnologie
Code: @

r *Koefficient poleznogo dejstvija, texnicheskij*
e Efficacy, technical
g Wirkungsgrad, technischer
> Effectiveness
Code: @

r *Kommunikacija*
e Communication
g Kommunikation
Code: SP

r *Kompensacija*
e Compensation
g Ausgleich
Code: @

r *Kompleks, agravno-promyshlennyi*
e Complex, agro-industrial
g Komplex, agro/industrieller
> Agro-Industrial Complex
Code: @

r *Kompleksnost' novovvedenij*
e Complexity of innovations
g Komplexitaet der Neuerungsprozesse
Code: OM

r *Konechnyj produkt*
e Final good
g Endprodukt
Finalprodukt
Code: @

r *Konkurencija sorevnovanie*
e Competition
g Konkurrenz
Wettbewerb
Code: @

r *Krivaja obuchenija*
e Learning corve
g Lernkurve
Code: @

r *Kriterij*
e Criterion
g Kriterium
Code: SP

r *Kriterij cel'*
e Objective (noun)
g Kriterium
Ziel
Code: SP

r *Lag*
e Lag
g Zeitverzoegerung
Code: @

r *Licensija*
e Licence
g Lizenz
amtliche Erlaubnis
Code: @

r *Masshtab proizvodstva*
e Scale of production
g Produktionsmassstab
Code: @

r *Materialy*
e Material
g Material
Code: SP

r *Material'no- texnicheskaja basa*
e Material-technical basis
g Materiell-technische Basis
Code: @

r *Material'noe xozjajstvo*
e Materials Management
g Materialwirtschaft
Code: SP

r *Medlenno progressirujushchij*
e Incremental
g In kleinen Schritten zunehmend
Code: SP

r *Mezhchelovecheskie otnoshenija*
e Human relations
g Zwischenmenschliche Beziehungen
Code: @

r *Metod Del'fi*
e Delphi Method
g Delphimethode
Code: SP

r *Metod kriticheskogo puti*
e Critical path method
g Methode des kritischen Weges
Code: @

r *Metod punktov otpravlenija*
e Reference point approach
g Methode der Bezugspunkte
Code: @

r *Metody Monte Karlo*
e Monte Carlo techniques
g Monte Carlo-Techniken
Code: @

r *Metody prognozirovanija - osnovnye ponjatija*
e Forecasting Methods-basic terms
g Prognosemethoden - Grundbegriffe
Code: OM

r *Mnenie*
ocenka
e Judgment
g Urteil
Ansicht
Code: @

r *Mnogie kriterii*
e Multiple criteria
g Mehrfache Kriterien
Code: @

r *Model*
e Model
g Modell
Code: SP

r *Modeli analiza riska*
e Risk Analysis Models
g Modelle der Risikoanalyse
Code: @

r *Modeli innovacija*
e Innovationsmodels
g Innovationsmodelle
Code: @

r *Modeli predel'noj effektivnosti*
e Frontier Models
g Modelle der Effektivitaetsgrenze
Code: @

r *Modeli prinjatija reshenij*
e Decision models
g Entscheidungsmodelle
Code: @

r *Modell matematicheskogo programmirovanija*
e Mathematical programming models
g Mathematische Programmierungsmodelle
Code: @

r *Moral'nyj iznos*
Ustarenie
e Obselescence
g Moralischer Verschleiss
Veraltung
Code: OM

r *Morfologicheskij analiz*
e Morphological analysis
g Morphologische Analyse
Code: OM

r *Multinacionalnye korporacii*
e Multinational Corporations
g Multinationale Konzerne
Code: SP

r *Multiplikativnye funkcii poleznosti*
e Multiplicative utility functions
g Multiplikative Nutzensfunktionen
Code: @

r *Naimenee razvitye strany*
e LLDC Least developed countries
g Am wenigsten entwickelte Laender
Code: @

r *Nakladnye rasxody*
e Overheads
overhead costs
g Gemeinkosten
Code: @

r *Narodno- xozjajstvennaja otrasl'*
e Economic division
g Wirtschaftsbereich
Wirtschaftsektor
Code: @

r *Nauka*
e Science
g Wissenschaft
Code: SP

r *Nauchnaja organisacija truda*
e Management Engineering
g Wissenschaftliche Arbeitsorganisation
Code: SP

r *Nauchnaja politika*
e Science policy
g Wissenschaftspolitik
Code: SP

r *Nauchno- texnicheskij progress*
e Technological change
g Wissenschaftlich-technischer Fortschritt
technischer Wandel
Code: @

r *Nauchno- texnicheskoe otstojanie*
e Technological Lag
g Wissenschaftlich-technischer Rueckstand
Code: SP

r *Nauchno- texnicheskoe prognozirovanie*
e Technology Forecasting
g Wissenschaftlich-technische Prognose
Code: SP

r *Nauchnotexnicheskoe otstavanie*
e Technology Gap
g Technologische Luecke
Code: sP

r *Nacionalnyj produkt*
e National product
g Sozialprodukt
Code: @

r *Nacional'noe bogatstvo*
e National wealth
g Nationalreichtum
Code: OM

r *Nezavisimyj po poleznosti*
e Utility-independent
g Nutzenunabhaengigkeit
Code: @

r *Neobratimost'*
e Irreversibility
g Irreversibilitaet
Code: SP

r *Neopredelonnost'*
e Uncertainty
g Unsicherheit
Unbestimmtheit
Code: @

r *Neravnovesie*
e Disequilibrium
imbalance
g Ungleichgewicht
Code:

r *Neravnovesie*
neuravnoveshennost'
e Maladjustment
disequilibrium
g Ungleichgewicht
Unausgeglichenheit
Code: @

r *Nexvatka rabochix mest*
e Job shortage
g Arbeitsplatzmangel
>> Job vacancy
Code: @

r *Nexvatka rabochix mest*
e Lack of jobs
g Arbeitsplatzmangel
Code: @

r *No- xou*
e Know how
g Erfahrung
Anwendungswissen
Code: SP

r *Novacija*
e Novation
g Neuerung
> Innovation
Code: @

r *Novovvedenie*
Innovacija
e Innovation
g Innovation
Neuerung
Code: OM

r *Novovvedenie, osnovnoe*
e Innovation, Basic
g Innovation, grundlegende
Code: @

r *Novovvedenie b processe proiz-*
vodstva
e Manufacturing Innovation
g Produktionsablauf - Innovation
Neuerung im Herstel-
lungsprozess
Code: OM

r *Novovvedenie izdelij*
e Product Innovation
g Produktinnovation
Erzeugnisneuerung
Code: @

r *Noushestvo*
e Novelty
g Neuheit
Code: @

r *Norm*
e Norm
g Norm
Code: SP

r *Normativnye modeli reshenija mnogokriterial'nych problem*
e Normative models of multiobjective decusion making
g Normative Modelle der Entscheidungsfindung unter mehrfacher Zielsetzung
Code: @

r *Normativnyj*
e Normative
g Normativ
Code: SP

r *Normativnyj prognoz*
e Normative Forecasting
g Normative Prognose
Code: @

r *Obnovlenie*
Renovacija
e Renewal
Renovation
g Erneuerung
Renovierung
>> << Innovation
Code: OM

r *Obrazovanie valovogo kapitala*
e Gross capital formation
g Bruttokapitalbildung
Code: @

r *Obrazovanie osnovnych fondov*
e Fixed capital formation
g Anlagefondsbildung
Code: @

r *Obratnaja svjaz'*
e Feedback
g Rueckkopplung
Code: SP

r *Obshchestvennaja texnologija texnologicheskij cikl*
e Resource processing system
g Technologischer Verarbeitungzyklus
gesellschaftlicher Produktionsprozess
Code: @

r *Obshchestvennoe uchenie*
e Societal Learning
g Gesellschaftliches Lernen
Code: OM

r *Ob"edinenie*
e Merger
g Vereinigung
Zusammenschluss
> Amalgamation
Code: @

r *Ogranichenie*
e Constraint
g Restriktion, Nebenbedingung
Code: SP

r *Ozhidaemaja cennost'*
Ozhidaemaja poleznost'
e Expected value (utility)
g Erwarteter Nutzen
Code: @

r *Okrushajushchaja sreda*
e Environment
g Umwelt
Umgebung
Code: SP

r *Operacional'noe okruzhenie*
e Operational environment
g Operationale Umwelt
Code: @

r *Operezhenie*
e Lead
g Verkauf
Code: @

r *Opros*
e Enquiry
Inquiry
g Erhebung
Befragung
Code:

r *Osvoenie na proizvodstva*
e Implementation into production
g Ueberleitung in die Produktion
Code: @

r *Osnovnye fondy*
e Fixed asset
g Anlagekapital
Grundfonds
Code: OM

r *Osnovnye fondy*
e Fixed capital
g Anlagefonds
Anlagevermoegen
Code: @

r *Otdelenie I i II obshchestvennogo proizvodstva*
e Department I and II of social production
g Abteilung I und II der gesellschaftlichen Produktion
Code: OM

r *Otnositel'naja effektivnost'*
e Relative efficiency
g Relative Effektivitaet
>> Efficiency Cycle
Code: OM

r *Otstavanie*
e Gap
g Luecke
Code: @

r *Ocenka*
e Evaluation
g Bewertung
Code: OM

r *Ocenka verojatnosti*
e Probability assessment
g Schaetzung von Wahrscheinlichkeiten
Code: @

r *Ocenka novovvedenij*
e Taxonomy of innovations
g Taxonomie von Neuerungen
> Historical Taxonomy of innovation
Code: @

r *Ocenka poleznosti*
e Utility assessment
g Nutzeneinschaetzung
Code: @

r *Ocenka proekta*
e Project evaluation
g Projektbewertung
Code: @

r *Ocenka texnologii*
e Technology assessment
g Technikfolgenabschaetzung
Technikbewertung
>> Socio-economic opportunity analysis
Code: SP

r *Paradigm*
e Paradigm
g Paradigma
Code: SP

r *Parameter*
e Parameter
g Parameter
Code: SP

r *Pervenstvo lidirujushchee polozhenie*
e Leadership
g Fuehrung
Code: @

r *Period cikla*
e Period of a cycle
g Periode eines Zyklus
Code: OM

r *Planirovannoe ustarenie*
e Planned obsolescence
g Geplante Veraltung
Code: OM

r *Podgotovka reshenij dlja novovvedenija*
e Decision Support for Innovations
g Entscheidungsvorbereitung fuer Innovationen
Code: OM

r *Podxodjashchaja texnika*
e Appropriate technology
g Angepasste Technik
Code: SP

r *Pokazateli novovvedenij*
e Indicators of innovations
g Kennziffern von Innovationen
Code: OM

r *Pokazateli struktury promyshlennosti*
e Industrial Structure - Indicators
g Kennziffern der Industriestruktur
Code: OM

r *Pokazateli tvorchestva*
e Creativity indicators
g Kreativitaetskennziffern
Code: OM

r *Politika*
e Policy
g Politik
Code: SP

r *Politika innovacij*
e Innovation policy
g Innovationspolitik
Code: OM

r *Politika rosta*
e Growth policy
g Wachstumspolitik
Code: @

r *Polozhenie*
e State of the Art
g Zustand
Code: SP

r *Pol'za vygoda*
e Benefit
g Nutzen, Vorteil
Code: @

r *Porog*
e Threshold
g Schwellwert
Code: SP

r *Porog effektivnosti*
e Breakeven point
g Gewinnschwelle
Kostenschwelle
Code: OM

r *Posledstvie*
e Impact
g Auswirkung
Code: SP

r *Postoronnye posledstvija*
e Side Effects
g Nebenwirkungen
Code: SP

r *Poteri*
e Losses
g Verluste
Code: @

r *Potok*
e Flow
g Fluss
Code: @

r *Potrebnost'*
e Need
g Beduerfnis
Code: OM

r *Pravila sinteza*
e Composition rules
g Regeln der Zusammenfassung
Code: @

r *Pravilo prinjatija reshenij*
e Decision rule
g Entscheidungsregel
Code: @

r *Predvaritel'noe izuchenie realizuemosti*
e Feasibility study
g Vorstudie, in der Moeglichkeiten und Alternativen abgeklaert werden
Code: @

r *Predvidenie*
e Anticipation
g Antizipation
Vorwegnahme
Code: OM

r *Predpochtenie*
e Preference
g Praeferenz
Code: @

r *Predpochtenie po vremeni*
e Time preference
g Zeitpraeferenz
Code: @

r *Predprinimatelstvo*
e Entrepreneurship
g Unternehmensfuehrung
Unternehmensleitung
Code: @

r *Predprinimatel'*
e Entrepreneur
g Unternehmer
Code: @

r *Predskazyvanie*
e Prediction
g Voraussage
Code: SP

r *Preobrazovanie energii*
e Energy conversion
g Energieumwandlung
Code: SP

r *Prepjatstvija dlja tvorchestva*
e Obstacles to Creativity
g Barrieren der Kreativitaet
Code: OM

r *Pribyl'nost'*
e Profit margin
g Rentabilitaetsrate
Profitrate
Code: OM

r *Pribyl'nost'*
Rentabel'nost'
e Rate of return
g Profitrate
Rentabilitaetsrate
Code: OM

r *Priznak*
e Attribute
g Kennzeichen
Merkmal
Code: @

r *Prikladnoe issledovanie*
e Applied research
g Angewandte Forschung
> v Research, applied
Code: @

r *Princip oplaty po trudu*
e Performance principle
g Leistungsprinzip
Code: @

r *Prinjatie mnogokriterialnyx reshenij*
e Multiobjective decision making
g Entscheidungsfindung unter mehrfacher Zielsetzung
Code: @

r *Prioritety*
e Priorities
g Prioritaeten
Code: SP

r *Prisposoblenie*
e Adaptation
g Anpassung
Code: SP

r *Problema*
e Problem
g Problem
Code: OM

r *Prognoz*
e Forecast
g Prognose
Vorausberechnung
Code: SP

r *Prognozirovanie, normativnoe*
e Forecasting, Normative
g Prognose, normative
Code: OM

r *Progressivnaja texnika*
e Technology, high
g Fortgeschrittene Technik
Code: SP

r *Progressivnye energeticheskie texnologii*
e Advanced Energy Technologies
g Progressive Energietechnologien
>> Alternative Energy or Exotic Energy
Code: SP

r *Prodovolstvennaja cepochka*
e Food Chain
g Nahrungsmittelkette
Code: SP

r *Proizvoditelnost' truda*
e Labor productivity
g Arbeitsproduktivitaet
Code: @

r *Proizvodstvennyj effekt fondov*
e Productivity of capital stock
g Kapitalproduktivitaet
Produktionseffekt der Fonds
Code: OM

r *Proizvodstvo sredstv proizvodstva dlja proizvodstva sredstv proizvodstva*
e Capital Goods Industry
g Kapitalgueterindustrie, Herstellung von Produktionsmitteln
Code: OM

r *Promezhutochnyj produkt*
e Intermediate good
g Zwischenerzeugnis
Halbfertigfabrikat
Code: @

r *Protivorechie otnoshenie obratnoj zavisimosti*
e Trade-off
g Widerspruch
Dilemma
Code: SP

r *Professional'noe neveshestvo*
e NIH Not invented here Syndrome
g Betriebsblindheit
Code: SP

r *Procedural'noe novovvedenie*
e Procedural Innovation
g Prozedurale Innovation
Code: @

r *Process vybora izdelij*
e Product selection process
g Produktauswahl
Code: @

r *Process dejstvija*
Procedura
e Procedure
g Bearbeitungsprozess
Prozedur
Code: OM

r *Process novovvedenija*
e Innovative process
g Neuerungsprozess
Code: OM

r *Process prinjatija novovvedenija*
e Adoption process
g Adoptionsprozess
Code: OM

r *Prjamye metody prinjatija mnogokriterial'nyx reshenij*
e Direct methods of multiobjective decision making
g Direkte Methoden der Entscheidungsfindung unter mehrfacher Zielsetzung
Code: @

r *Psevdoinnovacija*
e Pseudo Innovation
g Peudoinnovation
Scheininnovation
Code: OM

r *Ravnovesie*
e Equilibrium
g Gleichgewicht
Code: @

r *Razvedyvatelnoe prognoziro-vanie*
e Forecasting, exploratory
g Erkundungsprognose
Code: OM

r *Razvedyvatel'noe issledovanie*
e Research, Exploratory
g Erkundungsforschung
Code: SP

r *Razvedyvatel'noe issledovanie*
e Exploratory Research
g Erkundungsforschung
> Research, Exploratory
Code: @

r *Razmytoe mnozhestvo*
e Fuzzy set
g Unbestimmte Menge
Code: @

r *Razrabotki*
e Development
g Entwicklung
>> Research
Code: SP

r *Raspredelenie resursov*
e Allocation of resources
g Verteilung von Ressourcen
Code: OM

r *Rasprostranenie*
e Diffusion
g Diffusion
Verbreitung
Code: SP

r *Rastushchaja otrasl' pro-myshlennosti*
e Growth industry
g Wachstumsindustrie
Code: @

r *Racionalizacija*
e Rationalization
g Rationalisierung
Code: OM

r *Rekonstrukcija*
e Modernization
g Modernisierung
Rekonstruktion
Code: OM

r *Resursy rabochej sily*
e Human resources
g Arbeitskraefteressourcen
Code: @

r *Resurcy*
e Resources
g Ressourcen
Code:

r *Reshenie, udovletvoritel'noe*
e Solution, satisfying
g Loesung, befriedigende
> Satisfying Solution
Code: @

r *Risk*
e Risk
g Risiko
Code: @

r *Risk- Pol'za- Analiz*
e Risk / Benefit Analysis
g Risiko-Nutzen-Analyse
Code: SP

r *Rost proizvoditel'nosti i novov-vedenie*
e Productivity grouth and innovation
g Produktivitaetswachstum und Innovation
Code: OM

r *Rutinnyj opyt*
routinnoe znanie
e Routine knowledge
knowledge from experience
g Routineerfahrung
Routinewissen
Code: @

r *Rynochnaja ekonomika*
e Free-market economy
g Freie Marktwirtschaft
Code: @

r *S- Krivaja*
e S-curve
g S-Kurve
Code: SP

r *Serendipnost'*
e Serendipity
g Serendipitaet
Code: SP

r *Sinergisticheskie effekty*
e Synergistic Effects
g Synergistische Effekte
Code: OM

r *Sistema realizujushchaja novovvedenie*
e Innovatives System
g Innovierendes System,
System, das die Neuerung einfuehrt
Code: OM

r *Sistemnaja dinamika*
e System dynamics
g System dynamics
Code: @

r *Sklonnost' protiv riska*
e Risk aversion
g Risikoabneigung
Code: @

r *Soedinenie*
ob"edinenie
e Amalgamation,
merger
g Zusammenschluss
Fusion
Code: @

r *Softveir*
e Software
g Software
Code: SP

r *Social'naja vzaimozavisimost' novovvedenij*
e Social interdependence of innovations
g Gesellschaftliche Verflechtung von Innovationen
Code: OM

r *Social'no- ekonomicheskie vozmozhnosti*
e Socio-economic opportunities
g Sozialoekonomische Moeglichkeiten
> socio-economic opportunity analysis
Code: @

r *Spin- off*
e Spin-off
g Spin-off
Code: SP

r *Spros*
potrebnost'
e Demand
g Nachfrage
Bedarf
Code: @

r *Srednaja texnika*
e Intermediate Technology
g Zwischentechnik
mittlere Technik
Code: @

r *Srednaja texnika*
e Technology, intermediate
g Zwischentechnik
mittlere Technik
>> Appropriate Technology
Code: SP

r *Sredstva*
e Means
g Mittel
Code: OM

r *Sredstva proizvodstva*
e Means of production
g Produktionsmittel
Code: @

r *Stepen' izpol'zovanija*
e Degree of utilization
g Auslastungsgrad
Code: @

r *Stimul dlja kapitalovloshenija*
e Investment incentive
g Investitionsanreiz
Code: @

r *Stoimost'*
cennost'
e Value
g Wert
Code: @

r *Strategicheskoe planirovanie*
e Strategic planning
g Strategische Planung
Code: @

r *Strategija*
e Strategy
g Strategie
Code: SP

r *Strategija innovacii*
e Innovation strategy
g Innovationsstrategie
Code: @

r *Struktura novovvedenija*
e Structure of innovation
g Struktur der Innovation
Code: @

r *Struktura rynka*
e Market structure
g Marktstruktur
Code: @

r *Strukturnoe izmenenie*
e Structural change
g Strukturwandel
Code: @

r *Stupeni razvitija texniki*
e Levels of technology
g Entwicklungsstufen der Tech-
nik
Code: OM

r *Sub'ektivnaja verojatnost'*
e Subjective probability
g Subjektive Wahrscheinlichkeit
Code: @

r *Scenario*
e Scenario
g Szenarium
Code: SP

r *Syr'e*
e Raw material
g Rohmaterial
Code: OM

r *tvorchestvo*
e Creativity
g Kreativitaet
Schoepfertum
Code: OM

r *Tvorchestvo i rutinnyj opyt*
e Creativity and routine experience
g Kreativitaet und Routineerfahrung
Code: OM

r *Temp rosta*
e Growth rate
g Wachstumsrate
Code: @

r *Teorija igr*
e Game Theory
g Spieltheorie
Code: SP

r *Teorija izmerenij*
e Measurement theory
g Masstheorie
Code: @

r *Teorija poleznosti*
e Utiliy theory
g Nutzenstheorie
Code: @

r *Teorija reshenija*
e Decision Theory
g Entscheidungstheorie
Code: SP

r *Texnika*
e Technique
g Technik
>> Technology
Code: SP

r *Texnika dlja infrastruktury*
e Technology, Public
g Technik fuer die Infrastruktur
Code: SP

r *Texnicheskaja politika*
e Technology policy
g Technische Politik
Code: @

r *Texnicheskie revoljucii*
e Technical revolutions
g Technische Revolutionen
Code: OM

r *Texnicheskoe ustarenie*
e Technological obsolescence
g Technische Veraltung
Code: SP

r *Texnologicheskoe novovvedenie*
e Process Innovation
g Prozessinnovation
Verfahrensneuerung
Code: @

r *Texnologija*
e Technology
g Technologie
Technik
Code: SP

r *Texnologija, podxodjashchaja*
e Technology, appropriate
g Technologie, angepasste
> Appropriate Technology
Code: @

r *Tipy novovvedenij*
e Types of Innovations
g Typen von Neuerungsprozessen
> Classification of innovations
Code: @

r *Tolchok*
e Push
g Antrieb
Code: @

r *Tolchok so storony texnologii*
e Technology push
g Wissenschaftlich-technischer Antrieb
Code: @

r *Transfer texniki nauchno- texnicheskij obmen*
e Technology Transfer
g Technologietransfer
Code: SP

r *Trudovaja teorija stoimosti*
e Labor theory of value
g Arbeitswerttheorie
Code: @

r *Trudovye funkcii cheloveka*
e Functions of human labor
g Arbeitsfunktionen des Menschen
Code: OM

r *Trudoemkij*
e Labor-intensive
g Arbeitsintensiv
Code: @

r *Trudosposobnoe naselenie*
e Labor force
g Erwerbsbevoelkerung arbeitsfaehige Bevoelkerung
Code: @

r *Tjazholaja promyshlennost'*
e Heavy industry
g Schwerindustrie
Code: @

r *Udelnyj ves nauki i texniki v roste proizvoditel'nosti truda*
e Share of new Technology in Productivity Growth
g Anteil von Wissenschaft und Technik am Produktivitaetswachstum
Code: OM

r *Udelnyj ves novych izdelij*
e Share of new products
g Anteil neuer Erzeugnisse
Code: OM

r *Udovletvoritel'noe reshenie*
e Satisfying solution
g Befriedigende Loesung
Code: OM

r *Uzkoe mesto*
e Bottleneck
g Flaschenhals Engpass
Code: @

r *Upravlenie issledovatelskoj dejatel'nost'ju*
e Research Management
g Forschungsleitung
Code: SP

r *Upravlenie kapitalovlozhenijami*
e Investment control investment steering
g Investitionslenkung
Code: @

r *Upravlenie po iskljuchenijam*
e Management by exception
g Leitungsausnahmeprinzip
Code: @

r *Upravlenie po celjam*
e Management by Objectives
g Zielorientierte Leitung
Code: SP

r *Upravlenie proektom*
e Project management
g Projektleitung
Code: @

r *Uslovie*
e Condition
g Bedingung
Code: OM

r *Uslovie, dostatochnoe*
e Condition, sufficient
g Bedingung, hinreichende
Code: OM

r *Uslovie, neobxodimoe*
e Condition, Necessary
g Bedingung, notwendige
Code: OM

r *Uslovie, neobxodimoe i dostatochnoe*
e Condition, necessary and sufficient
g Bedingung, notwendige und hinreichende
Code: OM

r *Ustanovka priem*
e Approach
g Ansatz
>> Appropriate technology
Code: @

r *Ustojchivoe sostojanie*
e Steady State
g Stabiler Zustand
Code: SP

r *Fabrichnaja sebestoimost'*
e Operating costs
g Betriebskosten
Code: OM

r *Faza vnedrenija*
e Take-off stage
implementation stage
g Startphase
Einfuehrungsphase
Code: @

r *Faza zrelosti*
e Maturation stage
g Reifephase
Code: @

r *Faza okonchanija proizvodstva*
e Abandonment stage
g Auslaufstadium
Code: OM

r *Fazy processa novovvedenija i etapy processa reshenija*
e Phases of the innovation process and stages of the decision process
g Phasen des Innovationsprozesses und Stufen des Entscheidungsprozesses
Code: OM

r *Faktor proizvodstva*
e Factor of Production
g Produktionsfaktor
Code: OM

r *Faktory, vlijajushchie na novovvedenii*
e Factors influencing Innovations
g Faktoren, die Neuerungen beeinflussen
Code: OM

r *Fasa bystrogo rosta*
e Rapid growth stage
g Phase des schnellen Wachstums
Code: @

r *Fasa nasyshchenija*
e Saturation stage
g Saettigungsphase
Code: @

r *Fasovyj lag mezhdu dvumja vremennymi rjadami*
e Lead - lag relationship
g Phasenverschiebung zwischen zwei Zeitreihen
Code: @

r *Firma*
e Enterprise
g Unternehmung Unternehmen
Code:

r *Fon*
e Background
g Hintergrund
Code: SP

r *Fondy obrazovanija*
e Human Capital
g Bildungskapital Bildungsfonds
Code: OM

r *Fundamental'naja innovacija revoljucionnoe izmenenie tekniki*
e Basic Innovation
g Basisinnovation Technik
> Classification of innovations Historical taxonomy of innovations
Code: @

r *Fundamental'noe issledovanie*
e Basic research
g Grundlagenforschung
> Basic research
Code: @

r *Fundamental'noe issledovanie*
e Fundamental Research
g Grundlagenforschung
> Research Fundamental
Code: @

r *Fundamental'noe issledovanie*
e Research, Fundamental
g Grundlagenforschung
Code: SP

r *Funkcii novovvedenija (matematicheskie)*
e Innovation Functions (Mathematical)
g Innovationsfunktionen (Mathematische)
Code: OM

r *Funkcii novovvedenija v sisteme*
e Functions of Innovations in a System
g Funktionen der Neuerung in einem System
> Classification of Innovations
Code: @

r *Funkcional'noe zameshchenie*
e Substitution, Functional
g Funktionale Substitution
Code: SP

r *Funkcija*
Zadacha
e Mission
g Funktion
Aufgabe
Code: SP

r *Funkcija poleznosti*
e Utility function
g Nutzensfunktion
Code: @

r *Funkcija pol'zy*
e Value function
g Nutzensfunktion
Code: @

r *Xardvejr*
e Hardware
g Hardware
Code: SP

r *Xorosho- strukturizovannye problemy*
e Well-structured problems
g Starkstrukturierte Probleme
Code: @

r *Celevoe programmirovanie*
e Goal programming
g Zielprogrammierung
Code: @

r *Celi, nacional'nye*
e Goals, national
g Ziele, nationale
Code: @

r *Cel' rosta*
e Growth target
g Wachstumsziel
Code: @

r *Cikl effektivnosti*
e Efficiency Cycle
g Effektivitaetszyklus
Code: OM

r *Cikl materialov*
e Materials Cycle
g Materialkreislauf
Code: SP

r *Cheloveko- mashinnyi dialog*
e Man-machine dialogue
g Mensch-Maschine Dialog
Code: @

r *Chistaja stoimost'*
e Net value
g Nettowert
Code: @

r *Chistoe issledovanie*
e Research, Pure
g Reine Forschung
Code: SP

r *Shirota primenenija*
e Range of application
g Anwendungsbreite
Code: @

PART TWO: DEFINITIONS

Entry	Source	Cross References

Abandonment stage OM

Definition
The final stage in a product's life cycle. Production is diminishing and will soon cease as product is obsolete and of low profitability.

Adaptation SP

Definition
A structural or functional (behavioral) modification of a system, usually self-directed, in response to a change in the external pressures operating on the system.

Adoption process OM

Definition

A six-stage procedure by which an individual or an organization acquires a new product. The six stages are latent demand, information, interest, evaluation, trial, and definite acquisition.

Advanced energy technologies SP

See also:
Alternative energy
Exotic energy

Definition

Technology for developing energy from sources other than the conventional ones (fossil and organic fuels, nuclear fission, and river hydroelectric dams). Examples of alternative energy include, but are not limited to, solar (including biomass and wind), ocean generated energy, magnetohydrodynamics, nuclear fusion, synthetic fuels, and geothermal energy. In general, these technologies are considered to be in the developmental stage and their use has not become widespread. In some cases advanced energy technologies may be relatively close to fruition. In other cases many years of research are still needed to determine whether they will be feasible for significant usage.

Agro-industrial complex SP

Definition

A nucleus of complementary industrial and agricultural enterprises structured around a source of cheap, abundant energy, such as nuclear energy. An agro-industrial complex combines the ideas of synergism and economy of scale and might consist of:

A nuclear power station of 1,000 to 2,000 megawatts;

A plant to desalinate sea water at a rate of 1.3 to 3.8 million cubic meters per day.

A cultivable area of several thousand hectares capable of feeding several million persons on the basis of 2,500 calories per person per day; and

A certain number of industrial plants producing nitrate and phosphate fertilizers, aluminum, caustic soda, chlorine, and other products.

Agro-industrial complexes might have their greatest use in undeveloped regions, particularly desert regions near the sea.

The term is also used in planned economies for a certain type of integration of agriculture and the food industry.

Algorithm OM

Definition

A set of step-by-step actions or operators used to change given inputs into desired outputs. This set is strictly determined; it cannot be used for all tasks of the same type and its result is guaranteed.

Algorithm, heuristic OM

Definition

An algorithm which cannot guarantee the result but ensures a satisfactory approximation. Heuristic algorithms are incomplete algorithms: they include at least one non-elementary operator or step which can only be determined during the course of operations, not before.

Allocation of resources OM

Definition

The distribution of resources among different needs or users. A basic problem of every economic system is one of finding a means of allocating resources so as to achieve maximum efficiency. A dynamic allocation of resources represents an optimum between distribution of resources to push processes and to compensation processes. Push processes are linked to basic innovations; they ensure a long-term increase in efficiency. Compensation processes involve improvement- related innovations with a high short-term effect which then diminishes.

Alternative OM See also: Options

Definition

One of several ways of tackling a problem, each of which has the same approximate outcome. In the selection of one alternative, all other alternatives are excluded. Any particular alternative uses a determined set of resources, methods, and actors. This set can be given in variants, which differ quantitatively within an alternative.

Analysis SP

Definition

The action of taking something apart and examining its components. The very extent to which the term is used may seem to deprive it of much of its meaning. It is employed in a great many different senses, and in many combinations. Its meaning seems to depend somewhat on the discipline connected with its use. Thus the chemist makes an analysis when he discovers the quantity and quality of ingredients in something. The biologist and botanist use analysis to signify the operation of classifying a specimen. The psychiatrist uses the word to mean the treatment or cure of aberrant psychic behavior. The physician interprets it in terms of what happens in the laboratory of pathology. The mathematician uses the term in a variety of ways; for example: (1) he uses it as a technique for proving a theorem by assuming the truth of the theorem and then searching out the consequences; (2) since integral and differential calculus are commonly used in searching out these consequences, he tends to regard any application of calculus as a form of analysis; (3) still more loosely, he regards any problem amenable to mathematical solution as "subject to analysis;" and most loosely of all, (4) analysis becomes the establishment of--or search for--any kind of quantitative relationship.

The notion that analysis is an identifiable and describable process, independent of the discipline involved or the item being analyzed, is suggested by the large number of compound words hyphenated with it. For example: value-, failure-, cost-effectiveness-, operations-, systems-, stress-, reliability-, maintainability-, etc.

According to Merriam-Webster the word means to "resolve into its elements." (Separation of anything, whether an object of the senses or of the intellect, into constituent parts or elements.") Also, any statement or table exhibiting the results is "an analysis." The verb to analyze has as synonyms the following: separation, resolution, dissection, reduction.

There is a tendency to expand the scope of analysis to qualitaive as well as quantitative factors. In this sense analysis can be qualitative if it retains such other characteristics as order and logic, explicitness or replicability, definable scope and internal consistency.

Anticipation OM

Definition

A logically determined model of a possible future which has not yet been defined.

Appropriate technology OM

See also:
Intermediate technology,
Integrated technological basis of a developing country,
Levels of technology.

Definition

The discussion of technology in the developing countries that took place in the 1960s began with the concept of intemediate technology, i.e., technology between the manual and the advanced levels. Intermediate technology brings many benefits to the economy: it demands low capital intensity and it eases the mastering of the first stages of introduction. However, this concept cannot remove the gap between the manual and advanced levels.

Intermediate technology furthers semi-mechanized technologies (class b), but this cannot help developing countries to raise their standards of living. It is not possible to jump from the lowest technological level to the highest. In most cases, developing countries do not have the investments, skilled workers, and infrastructure needed for d technology. Nor is this technology suitable for creating a national technical base capable of producing enough goods to supply the population and secure full employment.

It is this dilemma which in the 1970s lead to a number of concepts of "appropriate technology". But what can be regarded as "appropriate"?

The developing countries are faced with the problem of allocating their limited resources and capital among different levels of technology so as to optimize their utilization of domestic natural and human resources so that they can then produce the stream of goods and services needed to meet the demands of their populations. Thus one cannot say what is the appropriate technology from the standpoint of a single company, branch, or territory. One must look at the economy as a whole, at the resource situation, and at the accumulation potential. Thus the prevailing approach, in which one only looks at the features of a single technology or at the technologies of a specific technological level, is inadequate. The developing countries need an efficient blend of different types and levels of technologies. True, there currently seems to be a deficiency of technologies which utilize the natural and human resources of the developing countries. These are often referred to as "soft" (small scale and low capital) technologies, which make extensive use of local labor and raw materials. These technologies are important in the present stage of development; we should place greater emphasis on developing such kinds of technology. But this can only become part of a country's technical basis.

The successful establishment of an integrated national technical base in the developing countries requires that governmental policy toward technology play a key role. The main goals of governments should be the following:

1. To create domestic complexes focusing on basic industry, mechanical engineering, consumer goods, and export industry.
2. To develop domestic agriculture for the accumulation of the means and manpower for domestic industry. This makes the success of technical innovation heavily dependent upon social innovation, including real agricultural reform and the development of agricultural cooperations. We must also bear in mind that for a long time to come, agriculture will be the base for the development of industry in the developing countries, not only from the standpoint of food and raw material supply, but also from the standpoint of manpower and sources

for financial investment. Only at an advanced level will it be possible to change this so that agriculture can be developed on the basis of industry. It is also necessary in the present stage that we make a serious commitment to the use of industrial processes for the improvement of agricultural efficiency.

3. To make optimum use of domestic resources, both natural and human.
4. To develop national self-reliance in the areas of mechanical engineering and production of equipment.
5. To extend and improve the domestic division of labor.
6. To maintain a mutually supportive relationship between traditional sectors, which will benefit from modernization, and modern sectors, which will need to draw labor and other inputs from traditional sectors.
7. To establish and maintain a close relationship between social innovation and technical innovations.
8. To lay a solid domestic scentific-technical foundation capable of both serving domestic needs and holding trained manpower, i.e., stopping the brain drain.
9. To facilitate selective transfer of technology from the developed countries so that they can better use international know-how without sacrificing national independence.
10. To secure a high level of technological uniformity and standardization.
11. To establish a national system for managing and planning science and technology.
12. To promote competitive export branches.

In seeking appropriate technology, one must keep in mind problems of employment and resources. In the next twenty years, more than 300 million additional jobs will be needed in the developing countries. Assuming that each job costs 10,000 dollars per year, then 150 billion dollars (10^9) dollars per year will be required to secure the working places required. While 150 billion dollars is a great deal of money, it is only half of what the world spends annually on armaments (350 billion dollars in 1978).

For mankind to live peacefully in solidarity, it needs a technology that is really appropriate. In stressing the social determination of technology, we cannot ignore such economic criteria as productivity, capital intensity, utilization of capacity, prices, taxes, interest rates, etc. It is necessary to assess social, political, economic, and technical indicators. Unfortunately, turbulence in the international economic system makes assessment uncertain and planning difficult.

On the one hand, we need to create more jobs through the use of technologies with low capital intensity. On the other hand, in order to realize exports, we need advanced technologies with high capital intensity.

Sometimes the price of capital can be lowered through government measures and the flow of foreign capital into the country will increase, as capital intensive solutions are preferred. As far as the capital coefficient is concerned, we must find the compromise that is most beneficial to the national economy. This can be done by (1) supporting vitally important areas of production with a very high capital coefficient (steelmaking, petrochemistry, energy, etc.); (2) supporting the main projects of the export industry where the capital coefficient is also high; and (3) promoting smaller capital-saving industries to meet local demand.

Asset OM

Definition

A physical property or intangible right that has a value and is possessed by a business or individual. Fixed assets include land, buildings, equipment, and long-term investments. Among the intangible assets are patents, copyrights, trademarks, and goodwill. Current assets include cash on hand, accounts receivable, inventories, and marketable securities. The innovation process touches on each of these types of assets.

Background SP

Definition

Phenomena forming the natural ambience of experimental research or ordinary situations. For example, the noise of natural electromagnetic radiation from solar activity is received on radio receiving sets as background, and naturally occurring terrestrial roadioactivity is detected as background radiation on geiger counters set to detect large deposits of radioactive materials.

In general, the background of any social, economic, environmental, political, psychological, scientific, or technological situation includes those phenomena which would distort the understanding or evaluation of the experiment experimental situation unless the phenomena were known and accounted for in the experiment or experience. They are the situational elements in relation to which a particular vector under consideration is to be evaluated or measured. Before this evaluation or measurement can be made, the background must first be determined.

An additional meaning is that of a briefing by an official, usually not for attribution, to media representatives or other interested parties, to provide a perspective on a particular policy, issue, program, controversy, or other matter.

Backlog of unfilled orders OM

Definition

A manufacturer's accumulation or orders for products that have not yet been shipped. The backlog of unfilled orders is normally very low during the implementation stage of an innovation, very high during the phase of rapid growth, and lower again during maturation, saturation, and decline.

Baseline SP

Definition

A reference point on some significant parameter against which changes over time can be measured.

Biotechnology SP

Definition

The application of knowledge generated within the discipline of discipline of biology and related life sciences to industrial processes and problems. Although the term is of quite recent usage, some of the processes to which it refers are as old as civilization, e.g., the application of enzymes in the fermentation processes to produce beer, wine, and vinegar from grain and fruit sugars.

Recent advances in the biological sciences have greatly expanded the scope of biotechnology. Examples of new areas of exploitation of microbiology range from the production of antibiotics from microorganisms and the manipulation of genes to produce new economically useful species, to the development of new organic chemicals by novel enzymes. Apparently the underlying distinction between new interests in microbiology and earlier applications is that purposeful intervention in the structure of the primary organic unit--the gene--by new techniques of molecular biology have become scientifically interesting, technologically feasible, and economically significant.

Breakeven point OM

Definition

The point at which all costs allocated to a product are equal to gross or net revenues from its sale.

Capital coefficient or capital output ratio OM

Definition

The ratio between the book value of a plant or unit of equipment and the gross value of output. In planned economies, this is called fund intensity. The capital coefficient is determined by by dividing the capital-labor ratio by productivity.

The capital coefficient is normally low in the first stages of the innovation cycle and increases during the maturation and saturation stages. During their final stages, the capital coefficient of the extractive industry is much higher than that of processing industry.

Capital goods industry OM

Definition

A term used in market economies to denote industry producing capital goods, such as buildings, machinery, and transportation equipment. A similar term used in planned economies is Department Ia of social production (or Group A of industry). Department I (or Group A of industry) refers to all industries producing the means of production. Department Ia includes production of machines, equipment, and buildings. Department Ib includes production of raw materials and intermediate products.

Citation analysis SP

Definition

An evaluation technique used to measure how technical information is transferred among scientific and other professional authors. The concept is one of counting and indexing the footnoted references of published papers. In this way, a measure of papers most often used by other scholars can be obtained. The higher a paper's ranking in the citation index, therefore, the greater the value hypothetically assigned to it as a source of ideas.

Citation indexes for scientific literature are available through several commercial groups, one of which is the Institute for Scientific Information (ISI) in Philadelphia. ISI first published the Science Citation Index (SCI) in 1963, and began a Social Sciences Citation for law reviews and periodicals for legal articles.

Proponents of citation analysis view this technique as a possibly useful tool for judging the value of proposed research projects or for assessing the impact of federally funded research and development.

Classification of innovations OM

See also:
Historical taxonomy of innovations

Definition

An innovation is a change in the technological system that has a particular effect on a given socioeconomic system or subsystem. Among the subsystems are: the complexes and subcomplexes of needs or demand (i.e., the demand for lighting); the complexes and subcomplexes of resources (i.e., sources of energy); and the resource processing cycles from the primary to the final stages (i.e., the wood cycle).

If we look at the innovation process from the standpoint of social systems, or corresponding subsystems and how we can control them, we see that these large systems have three goals:

1. To ensure their own existence and ability to function.

2. To balance the inner and outer relations of the system by relieving bottlenecks.
3. To find enduring means of ensuring efficiency in a changing environment.

Here one can differentiate among the three functions of innovation:

- continuation (Fortfuehrung)
- balancing (Ausgleich)
- push (Antrieb)

Consider for example the energy system. The use of existing primary resources is a continuing function of innovation.

In any given energy system there are certain bottlenecks or inequities which cause reduction in efficiency. By mobilizing new sources of energy, we can relieve these bottlenecks, thus rebalancing the entire system. This is a continuation function of innovation.

A third type of technological change gives a major long-lasting push to the entire system. In reality this transforms the existing system into a new one. Present bottlenecks are overcome, but new ones are established.

Following widespread terminology, we can distinguish between two opposing types of innovation:

1. Basic Innovations (BI): Fundamental I - Major I - Strategical I - Radical I - Discontinuous I - Major changes.
2. Improvement-oriented Innovations (II): Incremental I - Minor I - Tactical I - Rationalization I - Continuous I - Small changes.

The primary function of a basic innovation (BI) is to give a push to the existing technological system, thereby transforming it into a new system with eminently higher efficiency. The main function of an improvement-oriented innovation is to balance a given system by improving and stabilizing its efficiency. The rates of efficiency resulting from the implementation of these two types of innovation display typical patterns.

But in using the the well-known terms BI and II (also known as revolutionary technological changes and evolutionary technological changes) we deviate somewhat from the usual definition. In many studies this distinction refers simply to the degree of the change, whereas we are looking at innovations in terms of their impact on the socioeconomic system. If we look at the average efficiency of a given system, we will see a tendency for it to stagnate or decrease, which can be reduced but not halted by II. Only BI are able to overcome this tendency, assuming that their efficiency e^* is well above the average e and that their share in output is sufficiently high.

While the effects of BI are slower than the effects of II, they are far greater. Of course, this does not mean that the effects of II can be disregarded. In a particular area, the long-term effects of II are comparable with those of BI. They cannot cannot endlessly maintain the efficiency of a larger system; the endless asymptotic increase of efficiency through better balancing of elements is thinkable only in a closed system. But when we consider the relationship between the large system and the environment, we must take into account the possibility of sudden, or gradual but radical, changes. Such changes may lead to major bottlenecks, shortages of resources, and conflict situations that can only be mastered with radical and complex solutions.

So far, we have discussed only the positive contribution of innovations to the achievement of goals. Some goals, however, seem appropriate for meeting

the goals of a socioeconomic system or subsystem, but have in the long run a negative influence on the system. The primary or secondary consequence of this is damage to the efficiency of the system.

We call such innovations "pseudo-innovations", or SI (Scheininnovationen). Here should be noted that positive technological changes with positive socioeconomic potential sometimes appear as negative innovations.

Please note that we differentiate between technological changes in the narrow sense of the word and innovations.

So a major technological change (potentially a BI) may simply occur as an II or SI if it is unable to use its innovation potential to make the changes in conditions and relationships necessary for the efficiency of the new or renewed system. Conditions, of course, can vary from one point in time to another: what can become a BI at one point might be incapable of doing so at another. It is very important to establish positive feedback in the innovation process. An example of positive feedback in the past is the railway, whose innovation led to a higher demand for coal, which in turn required improved transportation, made possible through the railway.

The history preceding and following a basic innovation is formed by groups of smaller innovations. For example, the incandescent lamp was a basic innovation for which at first a number of smaller changes were needed. Since Edison's time the development of the incandescent lamp has been made up of a series of improvement-oriented innovations. Thus we can make a distinction between II that pave the way for BI and those that take advantage of a B's potential for efficiency. This shows us how closely the two interact. A basic innovation is the result of a long selection process from a wide field of smaller innovations competing with one another.

A basic innovation could be described as a package of technological changes that radically alter the quality of the system upon which they touch. New basic innovations create an enormous new potential for efficiency, only possible through a great number of improvement-oriented or incremental innovations.

Then there are some smaller technological changes in the manufacturing process and in organization which do not seem to be connected with a basic innovation.

Basic innovations vary in their technological level, their range of application, and their impact on the national economy. Technological level is closely connected with the kind and amount of mission-oriented fundamental research, applied research, and development that is needed. Thus it is understandable that a study by the IFO Institute proposed to call all technological changes that go through research and development stages basic innovations. The other extreme is to call only the main historical breakthroughs in technology, such as the steam engine, the tool machine, and electricity, basic innovations. Nor can we call every purely scientific or technical result (invention) a BI. An invention represents only an early stage of the innovation process. While it may have the potential for becoming a basic innovation, this depends on the concrete resource situation, on socioeconomic needs, and on the ability of a given society to master the innovation; one cannot talk about BI without social considerations.

We propose to regard as modern basic innovations those major technological changes which

- are based on basic and applied research,
- have a wide, well-defined range of application,

- are connected with new scientific-technological principles of varying orders.

Thus we can distinguish three kinds of basic innovations major, medium and minor BI. These BI give a great push to the whole socioeconomic system. As they have an enormous potential for efficiency, they can halt and reverse the tendency to use resources less efficiently.

A high technological level is also an indicator that the innovation is a basic one, but the effect of the technological level on the overall efficiency of the system is not linear. There have been basic innovations in the past (i.e., the Hargreave machine) that were not based on new scientific or technological principles. And other innovations having a high scientific-technological level did not find a wide range of application (i.e., the air lamp in the 19th century.)

Let us return to our discussion of improvement-oriented innovations. There are four types of improvement-oriented innovations:

- very important
- important
- normal
- marginal (small changes).

There are three kinds of pseudo-innovations (PI):

1. Simple product innovations which do not represent an improvement for the user. (Many changes in automobile design were of this type.)
2. Innovations which improve the efficiency of one process but reduce the efficiency of the overall system. (Certain plastic materials, for example, turned out to be inappropriate to user needs.)
3. Innovations which improve the efficiency of the system for a short time, but which eventually lead to major losses and imbalances. (An example of this would be some process innovations in the chemical industry which later had a negative influence on the whole environment.)

This gives us a total of ten main types of innovations: three types of basic innovations, four types of improvement-oriented innovations, and three types of pseudo-innovations. We believe that these are ten distinguishable types of innovations. Of course if we look at the ocean of innovations, we see that they build a certain continuum not measurable by one clear indicator. Some see this only as a continuum. But we must take into account the turning points or break-even points in complexity, in efficiency, and in manageability which obviously exist in the total field of innovations. For example, in the socialist countries all scientific-technological tasks of one planning cycle are associated with a certain level of administration from the firm to the center. These different types of technological tasks have various prerequistes in management and planning.

We think that it would be inappropriate to carry the classifications of innovations too far. However, this does not mean that for special studies and innovations we do not need a more detailed typology.

Closed cycle SP

Definition

A concept involving a flow of material through a system that does not discharge wastes but returns the flow to become input into the system. It is a hypothetical concept, as loss is probably unavoidable in even the most carefully designed and managed system. However, it is to be disinguished from energy cycles, in which the second law of thermodynamics applies, and in which the loss through entropy is generally calculable.

A respondent notes:

> Rather than a "hypothetical concept", I believe closed cycle is a "limiting concept", analogous to its usage in physical chemistry, which considers the ideal gas law as a "limiting law".

Communication(s) (and Communication Theory) SP

Definition

Communication is an essential element of all systems. In its simplest form, a communication is any transmission of meaning, by signs, signals, or symbols, between persons or stations. Communication takes many forms and employs many media.

Communication theory (cybernetics) concerns the relationship between communication and control. It refers specifically to the regulative processes of physical, biological, and behavioral systems, with a special emphasis on feedback which tells the system how to adapt itself to changing situations, enables control of the system on the basis of actual performance rather than expected performance. Negative feedback reverses the direction of the main system; positive feedback amplifies or intensifies the work of the main system.

Information theory is another complex aspect of communication theory. It proposes to measure the effect of operations by which a particular selection is made from a range of possibilities. It is related to probablility theory in that the measure of selectivity is a function of the probability of achieving the same result by chance.

Complexity of innovations OM

Definition

The complexity of the innovation process of an important indicator in management and planning and their necessary methods. In priniciple, complexity can be estimated according to two interlinked dimensions:

- stages of the innovation process, and
- certain elements of the manufacturing process, such as equipment, labor force, materials, energy, product, service, etc.

It is also essential that the complexity of innovations be measured and evaluated during their early stages, as the risks and effects of innovations

depend on their complexity. However, this does not occur in a linear scale. There are breakeven points, or turning points in complexity at which it is necessary to change the level and methods of innovation management. One can evaluate complexity by the number of elements touched upon, the intensity of the relationships among them, the requirements of a given element for new solutions, the number of external relationships, and similar indicators.

Condition OM

Definition
The circumstances influencing the existence or development of a fact or case.

Condition, necessary OM

Definition
The conditions without which a fact or case cannot exist.

Conditions, necessary and sufficient OM

Definition
The conditions that completely determine a fact or case.

Condition, sufficient OM

Definition
The conditions that cause the existence or development of a fact or case.

Conservation SP

Definition

A broad term generally conveying the idea of foregoing benefits in order to reserve them for the future. Among the shades of meaning encompassed by the term are: preservation of natural beauty in an unspoiled condition, frugal use of a scarce and essential material, prevention of needless consumption or waste of any resource, reservation of supplies of a resource for allocation among essential uses, accumulation or protection of reserves of a resource to ensure its future availability, and the concept of (maximum) "sustained yield" of resources such as forests.

Constraint SP

Definition

A limiting condition to be satisfied in the design or operation of a system. For example, the total cost may be a constraint: another might be the percentage of system life consumed in down-time. Physical size or weight constraints may be required. Compatibility of a system with other systems may impose constraints. Sometimes it is not easy to distinguish between constraints and design objectives. For example, for a corporation to operate at a profit is sometimes considered an objective and sometimes a necessary constraint.

Cost/Benefit Analysis Risk/Benefit Analysis

Definition

The relation between social benefits and social costs associated with the operations of a system under study. The benefits and costs include direct and indirect effects. Monetary equivalents are sometimes assigned to the non-materialistic values for the purposes of comparison and to clarify the relationships between benefits and costs.

A respondent offers the following amplification:

Cost benefit analysis deals with decisions of two kinds: (a) engineering or building, and (b) policy. In either case, alternatives are defined and compared in terms of their cost and payoff. Type (a) refers to choices of weapons system designs, for example, and type (b) to (departmental) policy decisions. This definition could be referenced to (cost effectiveness) since, historically, cost-effectiveness analysis preceded cost-benefit analysis. In the military area, in which cost-effectiveness analysis originated, the payoff was defined in terms of effectiveness of the military system. In the civilian area, "effectiveness" is replaced by "benefit". Admittedly, benefits in social systems are even more difficult to define than effectiveness in military systems.

Another respondent suggests that the term "cost/benefit analysis" signifies "a decision-making tool especially useful in obtaining a first ranking of large

public projects in terms of their priority for implementation. There has been an increasing attempt to widen the scope of both cost and benefit to include effects that have no obvious market valuations."

Cost/effectiveness analysis SP

Definition

This is a term widely used in systems analysis, and has been carriedd over into budgeting analysis. It signifies the ratio, over an explicit and finite time-span (such as product life in service), of cost in dollars and other tangible values to effectiveness. It should be noted that cost/effectiveness as an analytical expression is useful in dealing with tangible costs and measrable performance characteristics. Its application to programs with unpredictable results (such as scientific research projects) can lead to the undervaluation of the project. Experimental programs are not amenable to such analyses, except after the fact.

A definition used by the Research Analysis Corporation emphasizes the concept of precision:

> Cost-effectiveness analysis is the quantitative examination of alternative prospective systems for the purpose of identifying the preferred system and its associated equipment, organizations, etc. The examination aims at finding more precise answers to a question and not at justifying a conclusion. The analytical process includes trade-offs among alternatives, design of additional alternatives, and the measuremnet of the effectiveness and cost of the alternatives.

A British commentator endorses the RAC definition but protests the preceding comment, insisting that all cost/ effectivenss is "directed towards assessing uncertain future performance of systems."

Creativity OM (See also: societal learning and societal creativity push)

Definition

The ability to find new ideas, principles, and phenomena that produce a useful result. Creativity is closely linked with man's routine activities and experiences. As creative abilities are necessary to every stage of the innovative process, we must seek social, organizational, and technological measures that encourage human creativity.

Several modern economists view the resources of society strictly in terms of energy, materials, equipment, and necessary manpower. The economists of the 17th and 18th centuries often had a clearer understanding of the problem. For example, it was William Petty who first attempted to place an economic value on the population. But perhaps the human factor was less hidden by material resources at that time than it is today.

Creativity is a social phenomenon of various dimensions. It is less related to expenditures than are other social phenomena. We think that real participation in the change of the production and working process is a possible social

indicator for creativity.

Creativity and routine experience

OM

Definition

There is a close link between creative and routine activities. The solution to complex practical problems requires a certain blend of routine or simple know-how and creativity. Without routine there can be no success in solving practical problems; without creativity there will be little or diminishing success. Lord Rutherford once said:

> Every man depends on the work of his predecessor. When you hear of a sudden unexpected discovery--a bolt from the blue as it were--you can always be sure that it has grown up by the influence of one man on another, and it is this mutual influence which makes the enormous possibility of scientific advance.

While creativity is the opposite of routine, the mutual influence of know-how and creativity constitute a great driving force. Through creativity is is possible to automate a great deal of routine work.

This interconnection was shown using 35,945 technological changes in four industries as examples . A creativity coefficient based on the share of changes with new tasks and results was defined and compared with such economic indicators as economic effectiveness, routine experience, and labor saving factors. It was shown that the demand for routine experience increases with requirements for higher creativity.

Creativity indicators

OM

Definition

It is generally assumed that human intelligence falls into normal distribution in a given population. Empirical studies have found the standard deviation of 16 in the American IQ, with 68.26% having an IQ of 100 ± 16, 95.44% an IQ of 100 ± 32, and 99.74% an IQ of 100 ± 48.

But the determination of a real frequency distribution of intelligence is only possible through the use of special tests that have limited importance to the phenomenon as a whole. In addition, the concrete parameters of the frequency distribution are partly determined by social and educational factors.

Measuring creativity is an even more difficult task, although it may be possible using special creativity tests. IQ tests are not appropriate for this: it was found that people with relatively high IQs are less creative than people with lower IQs.

It is also very difficult to set an economic value on creativity. We can calculate the value of a mechanic's time as follows:

For work done	$5.00
For knowing how	$45.00
Total	$50.00

or of a lawyer's:

For waking up in the middle of the night and thinking about your case $500.00

This illustrates the fundamental difficulty of measuring in economic terms. In general, creativity is the human ability to find new thoughts that are goal-oriented and directly or indirectly connected with the improvement of human existence. But the question remains: It is possible to measure creativity in economic terms? Measurement in market terms presupposes comparability and exchangeability, but creative results are by definition not comparable. There is no strong correlation between labor time, value of labor, and creative results. There exists only a social correlation between free or disposal time and other conditions for creative work and the probability of creative results. But this correlation includes a number of social factors.

Creativity can be measured indirectly during the stages of research, development, and introduction and improvement by looking at results, process characteristics, personal characteristics, and participation figures.

Criterion (plural: criteria) SP

Definition

A standard or an explicit measure by which to evaluate any thing or activity. Criteria may be quantitative or qualitative, and objective or subjective. In effectiveness analysis, criteria are the elements to be measured to determine costs and benefits. In policy analysis, criteria are separate considerations employed to eliminate alternative options, or to establish priorities or preferences among options.

Cross impact matrix analysis SP

Definition

This is a method of correlation based on the assumption that every event under consideration can be assigned a probability of occurrence. By analysis, on the basis of estimated interdependency among the different events considered, an adjusted probability estimate of each event can be produced.

A different technique with a similar name, Cross-Support Analysis (also called "Decision Impact Analysis"), is described as a method "to aid in technologcial forecasting by the study and operational analysis of the effect of making and implementing complex decisions which affect and are affected by a large number of factors."

Decision support for innovation OM

Definition

A decision support system for decisions regarding innovations should:

- combine outcome-oriented and process-oriented approaches;
- reflect the multi-stage nature of innovations, their uncertainty, the mutual dependence among projects, and the major types of resources;
- be suited to multiple objective decision making (MODM);
- be (more or less) compatible with the existing planning mechanism and managemet system
- reflect the impact of future sources of uncertainty on actual partial decisions
- be suited to interactive man-machine dialogue
- be based on easily accessible data
- be based on existing problem-solving techniques that can be easily computerized.

To date, no model meeting all the above requirements has been created.

Decision theory SP

Definition

Even when all extraneous variables are held as closely under control as possible—as in an elegant scientific experiment-- the finding is still probabilisic. In the management of social programs, control of variables is much more partial. Accordingly, in choosing among options in program management, the manager or decisionmaker always makes his decision on the basis of partial and incomplete information. Decision theory is the term applied to the array of mathematical and other logical tools and procedures of systems analysis that may help to focus the issue and give guidance toward a rational decision under these conditions. The goal of a "good" decision, under this theory, is to maximize the probability of favorable outcome.

Decision tree OM

Definition

A decision tree is a convenient tool for structuring all of a decision makers notions about a project. With the help of a decision tree, one can represent and analyze a series of partial decisions to be made over time. Thus decision trees reflect one of the most important features of innovation decisions--their sequential character. A formal methodology based on decision trees can only be successfully applied, however, when the innovation project to be represented has reached a certain degree of maturity. Variables regarding basic construction, project versions, resource requirements, main sources of uncertainty, and development on a time scale, etc., must be relatively well defined.

Let us assume that a number of projects are to be evaluated and selected over a certain planning horizon, divided into T time periods. A decision is to be taken on N projects, each of them having j possible versions of completion (j = $1...j_j$). Projects branch out whenever decision nodes or chance nodes occur. A decision node on the time scale represents the point where the decision maker can influence the further development of a project under consideration by taking a decision from which a branch of a given set will be selected. Chance nodes are not under the control of the decision maker. Their outcome depends on change events such as changes in the price of raw materials and the availability of the necessary machinery in a certain time period. The length of the time periods in the model can be chosen in such a way that, aside from general limitations, we can assume that decisions about the innovation project are taken at the beginning of each period. The same assumptions can be made about chance events that are supposed to occur before a patial decision has be made. For each time interval and each project version, the resource requiremets are assumed to be known. The number and kinds of resources are specific to each particular case.

It is also assumed that the decision maker is able to assign probabilities to the chance outcomes of a chance node. This problem will be discussed later. All combinations of particular decisions and chance events have some outcome associated wth them which are measured in scales corresponding to the chosen multiple objectives. The presentation of innovation projects in the form of decision trees has several advantages.

- One can look at a number of projects as a whole;
- One can represent and adequately handle interrelated decisions at different points on the time scale;
- One is distracted from the less important features of the project;
- The decision maker is forced to present ideas, judgment, experience, intuition, and quantitative data in an integrated manner;
- Early detection of feasible options and bottlenecks is possible.
- The mutual dependencies between partial decisions and the main sources of uncertainty involved can be seen.
- It combines the outcome- and process-oriented approaches to decision making.

However, there are several weaknesses and problems in using decision trees to improve the selection and evaluation of innovaion projects:

(a) Decision trees cannot reflect the whole complex of factors influencing the real decision making process. This also refers to quantitative models. Building qualitiave factors into a decision tree is aa very difficult and subjective matter.

(b) The construction of a decision tree is time consuming. All data is needed at the same time and often decision makers are not willing to spend the time necessary to answer an analyst's questions about the preference system.

(c) It is extremely difficult to consruct decision trees for the very cases where their applicaion is most promising--for basic research and applied research topics at early stages of their development. A certain degree of confidence in both objectives and technical/commercial parameters of the projects is required.

(d) Certain methodological problems are specific to each case. Among these are:

- inclusion of new project proposals in future time periods,
- length of planning horizon (the problem of projects that have not been completed by the end of the planning period)
- interdependence among several projects,
- transfer between some different resources
- the amount of detail in the decision trees.

(e) Decision trees do not take into account strategic considerations which might greatly influence the selection of innovation projects. Not all important aspects of decision making in innovation projects are quantifiable. For this reason, mathemaical models for project selection may be misleadinng in some applications.

(f) Decision trees cannot reflect the whole lifetime of an innovation. It is impossible to specify resource requirements 5-7 years in advance. The kinds of resurces required for an innovation differ considerably from one stage to the next. Hence the analyst is forced to aggregate and he loses a great pat of the information available. Only rough numbers can be calculated with a model based on decision trees. But this refers to all economic-mathematical models pretending to support innovation decisions.

(g) Sometimes decision trees create the illusion of a freedom of choice, which due to constraints not formally included in the analysic, do not in fact exist.

(h) The basic model is linear.

Defect OM See also: Gap

Definition

An imperfection that impairs worth or utility. A lack of something that is necessary for goal satisfaction, for choice of appropriate means, or for know-how.

Delphi method SP

Definition

A type of procedure developed by Dalke and Helmer of the Rand Corporation for forecasting future events. It has been most commonly emloyed to estimate the probable time of achievement of specific technological or social goals. The technique involves the repeated ("iterative") consulting with numbers of informed persons as to when, to their best judgments, a specific event is likely to occur (i.e., when it actually will occur, not when it should occur), and providing them with systematic reports on the totality of judgments rendered by the group. The responses of all participants are then assembled and returned to the participants, at which time they are invited to reconsider their responses and to offer their defense for estimates that seem out of line with others made by the group. This information, along with revised estimates, is then circulated to the participants for further analysis and so on. The procedure may vary considerably, but

its primary utility is that it produces a well-considered consensus of the intuitions of a plurality of informed witnesses without injecting the bias of leadership influence, face-to-face confrontation, or group dynamics. As individuals, respondents are expected to clarify their own thinking, and the final decisions--according to the theory at least--will tend to converge by narrowing the range of estimates in response to the most persuasive arguments.

However, a respondent notes: "The Delphi method does not force consensus as implied by the term consensus forecasting. Polarization may be a perfectly valid result in a Delphi. The key features are anonymity and feedback among participants."

Demand pull hypothesis OM See also Science push hypothesis

Definition

The hypothesis that need or demand is the prime source of innovations. In reality, the "pull" of demand and the "push" of science are interlinked in a specific way. The higher an innovations' scientific-technological level, the more it is induced by a push from science, which is the result of a modifiable random process. The innovation can then by enhanced by a demand pull in the following diffusion stage. There is also a complicated interconnection among changes in societal needs, cultural approaches, and scientific developmets. In this sense, science is affected by the real needs of the production system.

Departments I and II of production OM

Definition

In planned economies, two major groups of social production are distinguished: Department I produces the means of production (machines and equipment, industrial buildings, materials) and Department II produceds consumer goods. Within industry, these are generally called Group A and Group B. The most important industry in Group A is the production of machines and equipment for the production of machines and equipment.

Determinants of innovative activities in indusrial organizations OM

Factor analysis of innovations can be made for different purposes. There are many such sources in literature, for example the study by Sumner Myers and Donald G. Marquis (NSF 1969) REFERENCE, THE PROJECT SAPPHO (1973) REFERENCE, "The Flow of the Industrial Innovation Process" on the example of 218 cases by L. Uhlmann (1978) REFERENCE, and others.

The Myers/Marquis gave an overview of factors affecting innovations and their proportions in several branches. Project Sappho was an investigation comparing pairs of successful and unsuccessful innovations. The statistical results indicated that innovations which had achieved commerical success could be distinguished from those which were failures by their superior performance in five major areas:

- the strength of management and the characteristics of managers;
- understanding of user needs;
- marketing and sales performance;
- efficiency of development;
- effectiveness of communications.

The Uhlmann study tried to identify the main types of innovations that can be distinguished by various combinations of factors.

All of these studies were for the specific purposes of planned economies.

Another study by H.-D. Haustein used 32 firms in a planned economy. The questions were:

- How strong is the influence of inhibiting factors in the innovation process at the level of state-owned enterprises?
- How strong is the influence of a firm's own ideas and measures in overcoming bottlenecks and barriers in the innovation process?

Twenty-six variables were investigated:

1. Insufficient supply from the supplier industry.
2. Technical difficulties
3. Stress from other production tasks
4. Insufficient supply of machines and means of rationalization
5. Failure to abandon unsuccessful processes
6. Inability to master a new process
7. Shortage of research and development personnel
8. Poor management; insufficient involvement by management
9. Overly long coordination time with superior management
10. Differences between managers and experts
11. Poor preparation for production
12. Delays in construction
13. Failure to reach planning targets. High costs
14. Insufficient technological and qualitative level

15. Conservative and obsolete views
16. Inexact and/or changing objectives
17. Delayed recognition of problems, lack of correct information
18. Changing demands
19. Instructions from government to limit the project
20. Insufficient transfer of knowhow to and from other branches
21. Cost-saving measures
22. Unfavorable price relations
23. Insufficient specialized knowledge
24. Uncoordinated development between branches
25. Better solutions by competitors.
26. New solutions overcome the initial project

Multivariate factor analysis lead to the identification of six main determinants for the innovation process in a planned economy:

1. Innovation potential
2. Strategic orientation
3. Capacity for current production operations
4. Cooperation and coordination
5. The know-how factor
6. Economic mechanisms, including price relations, incentives, and planning.

Development SP See also: Research

Definition

Loosely, any intensification in the use of technology, whether to raise the economic level of a geographic region, or to provide concrete means of improving the performance of a function or program. As distinguished from Research, Development is the employment of available information in the construction of a piece of operating hardware or a useful process, physical or social. In the usage of science policy, Development signifies the systematic use of the knowledge and understanding gained from scientific research directed toward the production of useful materials, devices, or methods, including design and construction of prototypes and demonstration of processes. In industrial practice, the term "pilot plant" is often used to refer to a principal phase of the process of Development—the proving out on a small scale of a new industrial concept.

Diffusion OM

Definition

Some persons distinguish between the first application of a new technology, i.e., the transfer of technology from the applied research phase to application) and subsequent, more general application of it. The term, Diffusion, is commonly applied to the transfer of a new technology from the first commercial use to} a number of competing users.

Directive DM

Definition

Authoritative guideline issued by the central administration level or by the highest bodies of communist party for economic policy and planning in socialist countries. Obligatory guidelines for improving the performance of an action.

Discounting SP

Definition

Introduction of the economic factor of the future cost of capital, to be changed against realized future income produced by a proposed investment of the capital. For investments yielding returns in the very long range future the discount can be a major percentage of the total investment.

Economic indicators SP

See also:
Social indicators

Definition

Statistical series reflecting changes in the national economy over time. Examples include: gross national product, wholesale price index, unemployment level (aggregated and disaggregated by categories), disposable income, new capital formation, etc. An important impetus was given to the use of Economic Indicators in the U.S. by enactment of the Employment Act of 1946, Public Law 79-304, 60 Stat. 33, approved February 20, 1946. This measure declared it to be the "continuing policy and responsibility of the Federal Government" to manage its affairs to "promote maximum employment, production, and purchasing power." To coordinate this effort, there was created a Council of Economic Advisers, one of whose functions was (sec. 4(c)(2)):

> ...to gather timely and authoritative information concerning economic developments and economic trends, both current and prospective, to analyze and interpret such information * * * for the purpose of determining whether such developments and trends are interfering, or are likely to interfere, with the achievement of [the indicated policy], and to compile and submit to the President studies relating to such developments and trends.

Economy of scale SP

Definition

A term of industrial economics, referring to a type of comparative economic advantage dependent on size of installation, quantity of items produced, or volume of throughput. The concept involves recognition that some production costs are relatively fixed, regardless of the size of the enterprise, while the unit costs of other inputs tend to decline as size increases. Thus, production costs tend to decline as the enterprise is scaled up. This is not an invariable advantage, however: for example, the cost of maintaining technological competitiveness rises sharply along with scale.

Ecosystem SP

Definition

The ecosystem, the basic functional unit in ecology, is "any area of nature that includes living organisms and nonliving substances interacting to produce an exchange of materials between the living and nonliving parts." (Odum, *Fundamental of Ecology*.) An example of an ecosystem is a lake.

An ecosystem is conveniently described in terms of four constituents: "(1) abiotic substances, basic organic and inorganic compounds of the environment; (2) producers, autotrophic organisms, largely green plants, which are able to manufacture food from simple inorganic substances; (3) consumers (or macroconsumers), heterotrophic organisms, chiefly animals, which ingest other organisms or particulate organic matter; (4) decomposers (micro-consumers, saprobes or saprophytes), heterotrophic organisms, chiefly bacteria and fungi, which break down the complex compounds of dead protoplasms, absorb some of the decomposition products, and release simple substances usable by the producers."

Effectiveness OM

See also:
Relative efficiency

Definition

Effectiveness is a very broad term, including all direct and indirect expressions for the relation between output and input of a system. Its main expressions are

Technical Efficacy, e.g., Lumen/Watt
Economic Efficiency, e.g., Return/Book Value
Social Effectiveness, e.g., Free Time/Labor Time

All these expressions can be made by direct measurement of single variables by aggregation through money and/or time and by evaluation. In reality the three levels overlap in the following form (Table 1):

Table 1.

Denominator Numerator	Technical efficacy	Economic efficiency	Social effectiveness
Technical efficacy	*Lumen* Watt	*Lumen hours* lamp costs	*Consumption of calories* free time
Economic efficiency	*Price* Kg	*Return* Book value	*National income* employees
Social effectiveness	*Life expectancy* Consumption of calories	*Free time* labor time	Number of *educated persons* population older than 6 years

Efficacy of factors, influencing innovation OM

Definition

Factors influencing innovations can occur as a blockade, an obstacle a facilitator or as an incentive. This efficacy changes over the stages Research, Development, Application, and Exploitation.

Efficiency cycle OM

See also: Effectiveness, Efficiency, Impact of basic and improvement innovations, Relative efficiency

Definition

Efficiency of an innovating system is occurring in a certain cycle including the stages of Take-off, Rapid Growth, Maturation, Saturation and Decline. The following scheme shows the characteristics of this efficiency cycle which were derived from many case studies. In the first part of this scheme technological features are described. Comparing them, some obvious trade-offs between these indicators are found which are very important for technological policy in an industry. For example there is no congruency between product change and process change especially in the firs first three stages. The question is, if and for how long, the decline in efficiency growth rates of product change can be compensated by the higher efficiency growth rates of process change.

In the second part of the scheme (pos.9-17) an economic description of the cycle is given. From this one can see that the management requirements are quite different over the five stages. Fluctuations in efficiency are very often the result of a postponed or even inappropriate reaction of management to the changes. (N.b. Table 2.)

A more aggregated trade-off is found in the last three lines. Growth rates of absolute efficiency are normally the highest in the second stage. But the

Table 2.

	Stages Characteristics	Take-off	Rapid growth	Maturation	Saturation	Decline
1	Example	Solar energy	Micro-electronics	Synthetic fibers	Shoe-making	Ship-building
2	Product change	very high	high	medium	low	very low
3	Process change	low	medium	high	medium	low
4	Number of technological opportunities	very high	high	medium	low	low
5	Dominating type of innovations	basic	improvement	improvement	improvement	pseudo
6	Predominant type of chane in production units	new establish-ment	enlarge-ments	total moderniza-tion	rationali-zation	rationali-zation
7	Technological policy	push	push and compensation	compensation of bottlenecks	compensation	compensation
8	Patent activity	high	very high	medium	low	very low
9	Economic organization	very flexible	flexible increasing number of firms	increasing vertical integration high economics of scales	increasing diversifica-tion number of firms declining	number of firms declining
10	Competitive organization	Product performance dominating	Product performance dominating	Quality dominating	Price dominating	Outsider innovating
11	Export policy	low export activities	high share of exports	declining share of exports	production is moved abroad	production is moved abroad
12	Labor demand	rapidly increasing	increasing	stagnating	falling down	falling down
13	Capital intensity	low	high	high	very high	high

Stages Characteristics	Take-off	Rapid growth	Maturation	Saturation	Decline
14Critical human inputs	scientific and engineering	management skills	unskilled and semi-skilled labor	more skilled workers	
15Management	high risk informal organization	entrepreneur-ship dominating	experienced organizers	rather bureaucratic	change in top management
16Societal need	very high	high	medium	medium	low
17Demand	low	high	very high	medium	low
18Absolute	very low	very high	high	medium	low
19Allocation	low	medium	high	very high	medium
20Sum of benefits	very low	medium	high	very high	low

absolute sum of benefits is normally the highest in the saturation stage. This is an important reason for the fact that sometimes management is not aware of the threatening transition to the next stage of decline.

A classical example for the efficiency cycle can be found in lighting Industry. In the Take-Off stage between 1880-1905 the battle between gas-lighting and electric lighting was not decided yet. After 1905 came a phase of rapid growth in the technical level of the product and gas lighting was defeated. Then came a longer time of maturation in the twenties and thirties with a rather low increase in lmh. After a major improvement in the end of the thirties a long period of saturation began. In the same a considerable increase in process innovation can be noticed.

OM

Efficiency impact of basic and improvement innovations

Definition

The main function of Basic Innovations (BI) is to give a push to the existing system of technology and to change it into a new system with eminently higher efficiency. The main function of Improvement Innovations (II) is balancing the given system by improving its efficiency. However, we have to take into account that basic innovations are always a certain complex of smaller changes. In this sense the difference between type BI and II is relative. But basic innovations consist of smaller changes, leading over time to increasing returns.

Improvement innovations starting from the given, more or less old technology, lead over the same time-span (10 years and more) to diminishing returns.

The relationship between push and compensation policy, with the help of two innovation types, can be demonstrated by the example of investment allocation. All investments of a given industry can be subdivided into

$$I^* = I_1 + I_2 + C \tag{1}$$

where

I_1 = Investment for overcoming bottlenecks in technical equipment, per employee (compensation investments),
I_2 = Investment for introducing principally new technological solutions (push investments), per employee,
C = Replacement and continuation investments.

Optimization is necessary only for

$$I = I_1 + I_2 \tag{2}$$

The subsequent shares of compensation and push investments are:

$$i_1 \frac{I_1}{I}$$

$$i_2 = \frac{I_2}{I} \tag{3}$$

and $i_1 + i_2 = 1$.

If the main criterion is saving of labor force we take the replacement coefficient:

$$l_i = \frac{L_0 P' - L_1}{I} 100(\text{percent}) \tag{4}$$

where

$L_{0,1}$ = number of employees at the time 0 or 1,
p' = index of output (P_1 / P_0)
I = investments
$L_0 - L_1$ = absolute saving of labor force
$\hat{L}$ = $L_0 P' - L_1$ = relative saving of labor force.

So the coefficient l_i shows how many employees are (relatively) replaced by a given sum of investments. This coefficient is different for compensation and for push investments, but in both cases we find an invariance: spending more investments replacement coefficient l_i increases up to a certain point and then decreases.

Assuming a very simple dependency including this invariance one can write:

$$\hat{l}_{i1} = a_{12} i_1 - a_{13} i_1^2$$

$$\hat{l}_{i2} = a_{22} i_2 - a_{23} i_2^2 \tag{5}$$

The first coefficient $\hat{l}_{i1}$ shows the relative replacement over the share of compensation investments i_1 and the second coefficient $\hat{l}_{i2}$ shows the relative replacement over the share of push investments. In general parameters a_{ij} are

quite different in both cases. Compensation investments have rather high replacement effects at the beginning, but then fast diminishing effects. Push investments have rather low replacement effects at the beginning, increasing later on and then diminishing.

The whole relative economy of labor is the sum of both types of replacement:

$$\hat{L} = \hat{L}_{i1} + \hat{L}_{i2} \tag{6}$$

$$\hat{L} = I_1 \cdot \hat{l}_{i1} + I_2 \hat{l}_{i2} \tag{7}$$

$$\hat{L} = I_1(a_{12}i_1 - a_{13}i_1^2) + I_2(a_{22}i_2 - a_{23}i_2^2) \tag{8}$$

and by $i_1 = 1 - i_2$ we find

$$\hat{L} = i[i_2(-2a_{12} + 3a_{13}) + i_2^2(a_{12} - 3a_{13} + a_{23}) + i_2^3(a_{13} - a_{23}) + a_{12} - 1_{13}] \tag{9}$$

$$\hat{L} = I9d_2 i_2 + d_4 i_2^3 + d_1) \tag{10}$$

From

$$\frac{d\hat{L}}{d_{i2}} = I(d_2 + 2d_3 i_2 + 3d_4 i_2^2) = 0 \tag{11}$$

$$i_2^2 + \frac{2d_3}{3d_4} + \frac{d_2}{3d_4} = 0 \tag{12}$$

we get the optimal solution

$$i_{2(1,2)} = -\frac{d_3}{3d_4} \pm \sqrt{\frac{\overline{d_3}}{3d_4} - \frac{\overline{d_2}}{3d_4}} \,. \tag{13}$$

We must state that the assumption of two quadratic equations is quite arbitrary. It may be more appropriate to use an exponential function for this purpose.

The effects of BI take longer than the effects of II, but they are higher. Of course, this does not mean that one can forget about the effects of II. Over a longer period the effects of II are comparable with the effects of BI in a certain area. One has to bear in mind that BI and II are two sides of one coin. Underestimation of II is as dangerous as the fear of BI. A major example is the development in metallurgy. Nevertheless II are not able to ensure the endless efficiency of a larger system. Limitless asymptotic increase of efficiency through better balancing of elements is thinkable only for a closed system, but when considering the relations of the large system with the environment one has to take into account the possibility of sudden or not so sudden but tremendous changes. These changes may lead to principal bottleneck resource deficits and conflict situations which which can only be mastered by complex radical solutions.

Basic innovations may have a compensatory function without a push in the efficiency of the first step of their applications. This can be the result from the delay in realizing the basic innovation.

Ekistics SP

Definition

A term derived from the Greek word for "house" by Constantinos Doxiodis, signifying the technology of human habitation.

Energy SP

Definition

Energy is the capacity to do work. It involves a force acting over distance to move a mass or overcome a resistance. energy takes chemical, mechanical, electrical, thermal, nuclear, radiant, and gravitational forms. A spring can be compressed to store mechanical energy and do work as it return returns to its relaxed shape or position; a charge of gun powder has chemical energy and does work by burning explosively. A mass may posses energy by the nature of its physical position (potential energy) or by the nature of its motion (kinetic energy). Scientists use different units to quantify its various forms. Physicists use joules, ergs, and electron volts; biologists use calories; and engineers use British thermal units (Btu) and kilowatt-hours. Quantities of energy are mathematically equated to each other by conversion equations like: 1 joule = 10 million ergs; 4.184 joules = 1 calorie; and 1.34 horse power hours = 1 kilowatt-hour.

Energy tends to change from one form to another, usually ending up as heat.

The Btu, an amount of heat required to raise the temperature of one pound of water one degree Fahrenheit, has evolved as a common energy unit. The Btu equivalents of certain fuels and electrical production are the following:

	Btu.
Crude oil, 1 barrel	5,800,000
Natural gas, 1 cubic foot	1,032
Coal, 1 ton	24-28,000,000
Electrical production, 1 kilowatt-hour	3,412

Because the Btu is a small amount of energy, large quantities are often expressed as exponentials (10^{12} or 10^{15}, e.g.) of the Btu.

Energy Conversion SP See also: Energy

Definition

Energy exists in a number of forms and is capable of being changed from one form to another in many ways.

The burning of coal to convert chemical energy to heat, the use of solar energy to provide electricity to heat or cool a house, and the cellular metabolism of food to provide a living body with calories are examples of energy

conversion. In any energy process, some of the energy is converted to heat or light or is otherwise lost to the system. Consequently, after conversion, the remaining energy can do less work than previously. In this sense, the transformation of energy from one form to another is never 100 percent efficient.

Einstein's famous formula $E = me^2$ equates energy with mass "m" and the speed of light "c". According to this equation, if one kilogram of matter is entirely converted into electrical energy, it yields 25 billion kilowatt-hours of electricity.

Engineering SP

Definition

The profession in which a knowledge of the mathematical and natural sciences gained by study, experience, and practice is applied with judgment to develop ways to utilize economically the materials and forces of nature for the benefit of mankind. It is possible that this definition is too severe in excluding the contributions to engineering design of psychology and anthropology (human factors engineering), biology and medical research (bioengineering), and the long lists of specialized disciplines required for systems engineering.

Entropy SP

Definition

Entropy is an abstract concept of the process of loss in the relative order or arrangement of the constituent elements of a closed system. It is "measured" in terms of the energy flows or the arrangement of molecules in the system. A highly ordered structure, like a pure crystal, has low entropy. The random molecular arrangement of a gas has high entropy.

In the systems concept, the purpose of the system is to preserve low entropy, in other words to maintain stability by adapting to change in external or internal stresses, without loss of its operational character. The terms Steady State and homeostasis (q.v.) are used in different disciplines to convey a similar meaning.

Environment SP

Definition

This term refers to the total set of things, influences, conditions, and forces in relation to some referent. One may speak of the environment within some space or volume (organism, city, ocean, etc.) or of the environment surrounding some locus (organism, hill, planet, etc.).

The most common usage of the term is in a biological or, more broadly, a natural science sense in reference to the total surroundings of the earth: air, land, water, flora and fauna (including man), radiation from space, and so on.

These surroundings include both active and passive elements. Occasionally the term is used by laymen in a sense differentiating the so-called natural environment from man and his activities, as in the expression "man's destruction of the environment."

The concept of "environment" has proved so meaningful that the world has become incorporated into the jargon of many disciplines with slightly altered references. For example: businessmen may speak of the "business environment," referring to the totality of social, economic, political, and technological forces within which their business is conducted. Systems analysts use the term to refer to all relevant elements or forces external to and impacting on a system and also to all relevant elements or forces within a system that impact on components of it.

Evaluation OM

See also:
Alternatives,
Effectiveness,
Efficiency,
Goals

Definition

Associations of given possibilities with figures or qualitative statements in order to compare and to choose one or some of them. Normally such associations are made or aggregated in terms of efficiency or effectiveness. Evaluations are necessary in various stages of the decision process and phases of the innovation process. They include directly or indirectly also an risk assessment.

Evaluation is realized by the step

- Formulation of alternatives
- Determination of goals
- Formulation of an objective function
- Assessment of goal satisfaction of the alternatives
- Choice of most effective alternatives

Externalities SP

Definition

This term can be defined in at least three ways: as an economic term, as an element of communications theory, or as a factor relating to social systems. Economically speaking, externalities are costs or benefits not taken into account in a transaction or system of transactions. In this usage, the right of an industry to pollute a stream (i.e., a "free good") when it is not charged against the cost of doing business would be an Externality. In Communications Theory, an Externality is an aspect of the operation of a system that generates no Feedback (q.v.). As applied to social systems, an Externality is an aspect of changed environmental stress that has not been perceived or has not motivated an adaptive adjustment of the organism or social system.

Extrapolaton in forecasting (PE) OM

Definition

Hypothetical extension of laws, theories, or single statements beyond the field of past experience on future events (PE I) or connection between the past experience and new hypotheses on future developments (PE II).

Factor of production OM

Definition

An economic resource which goes into the production of a good. The three main production factors are land, production means and labor. Technological progress is sometimes called the fourth factor of production. Relative scarcity of land, production means and labor can be overcome or reduced only by innovations.

Factors influencing innovations OM

See also: Determinants of innovative activities in industrial organization, Efficacy of factors, influencing innovations

Definition

Innovation research has yielded a vast amount of influencing factors of the innovation process, especially of those factors acting as barriers to innovation. Obviously, it is not feasible to compile a list of factors from literature which does not contain overlapping and double countings under different terms, and which is exhaustive. One can mention the following main groups of factors.

Innovator:

a. Input, output
   - a.1 Input related factors: necessary quantities and qualities of input (production) factors
   - a.2 Output related factors: knowledge and utilization of the properties and applicability of the technique.

b. Interplay of innovative persons
   - b.1 Interplay of the functional roles which have to be fulfilled to accomplish innovative activities
   - b.2 Characteristics of innovative persons who play the roles.

Organization

c. Resources

d. Organizational dimensions

d.1 RElationships with the environment
d.2 Internal dimensions
e. Organizational measures
e.1 Planning measures
e.2 Control measures

Environment

f. Resources
g. Environmental dimensions
g.1 Economic sector
g.2 Political sector
g.3 Social sector
h. Environmental measures
h.1 Economic sector
h.2 Political sector
h.3 Social sector

Feedback SP

Definition

"The control of a machine on the basis of its *actual* performance rather than its expected performance is known as feedback, and involves sensory members which are actuated by motor members and perform the function of tell-tales or monitors—that is, elements which indicate a performance. It is the function of these mechanisms to control the mechanical tendency toward disorganization; in other words, to produce a temporary and local reversal of the normal direction of entropy."

The concept of Feedback is extended by Wiener to human and information systems, as well as to mechanical systems. He writes:

> It is my thesis that the physical functioning of the living individual and the operation of some of the newer communication machines are precisely parallel in their analogous attempts to control entropy through feedback. Both of them have sensory receptors as one state in their cycle of operation; that is, in both of them there exists a special apparatus for collecting information from the outer world at low energy levels, and for making it available in the operation of the individual or of the machine. In both cases these external messages are not taken neat, but through the internal transforming powers of the apparatus, whether it be alive or dead. The information i is then turned into a new form available for the further stages of performance. In both the animal and the machine this performance is made to be effective on the outer world. In both of them, their ***performed*** action on the outer world, and not merely the ***intended*** action, is repeated back to the central regulatory apparatus.

Elsewhere, Wiener relates Feedback to learning:

> . . . ***Feedback***, the property of being able to adjust future conduct by past performance. Feedback may be as simple as that of the common reflex, or it may be a higher order feedback, in which past experience is used not only to regulate specific movements, but also whole policies of behavior.

Such a policy-feedback may, and often does, appear to be what we know under one aspect as a conditioned reflex, and under another as learning.

Positive feedback amplifies, enhances, or stimulates the performance of a machine or system. Negative feedback dampens, diminishes, or discourages the performance or adaptive response of a machine or system.

Figure of merit SP

Definition

An engineering term applied to an item or element of performance—or a combination of several such—that can be quantified, and to which some preferred value of acceptability can be assigned. The Figure of Merit may indicate the point at which the efficiency of a process makes it economic, or the level of performance of a military system at which deployment becomes warranted. The term does not suggest an ideal attainment but rather achievement of "Satisfying" (q.v.).

Fixed asset OM

Definition

An asset of a relatively permanent nature, such as land, buildings and machinery.

Food chains SP

Definition

The transfer of food energy from the source in plants through a series of organisms with repeated eating and being eaten is referred to as the *food chain*. At each transfer a large proportion, 80 to 90 percent, of the potential energy is lost as heat. Therefore, the number of steps or "links" in a sequence is limited, usually to four or five. The shorter the food chain (or the nearer the organism to the beginning of the chain), the greater the available energy. Food chains are of two basic types: the *grazing food chain*, which, starting from a green plant base, goes to grazing herbivores (i.e., organisms eating living plants) and on to carnivores (i.e., animal eaters); and the *detritus food chain*, which goes from dead organic matter into microorganisms and then to detritus-feeding organisms (detritivores) and their predators. Food chains are not isolated sequences but are interconnected with one another.

Forecast SP See also: Futures research, prediction

Definition

Loosely, Forecast is synonymous with Prediction. However, it is properly distinguished from it in that a Forecast is a probabilistic statement at a relatively high confidence level that a specified event will occur by a specified future time or within some specified time period. A respondent offers the following list of methodological types of Forecasting: probabilistic forecasting, Delphi techniques, gaming, cross impact analysis, scenario building, extrapolation techniques, contextual mapping, precursive analysis, brainstorming, statistical models, expert panels, relevance trees, network analysis, historical analogy, operation models, individual "expert" forecasting, simulation, and causal modeling.

Forecasting, exploratory OM See also: Normative forecasting

Definition

Disclosure of future possibilities in society, economy or technology, which may arise from our present scientific knowledge or intuition.

Forecasting methods –Basic terms OM

Definition

See Table 3.

Directions of forecasting methods	Elements of forecasting methodsl Extrapolation PE	Backcasting PB	Integration PE+PB
Exploratory forecasting EF	Extrapolation of existing processes	Backcasting from creative assumptions on future events and discoveries	Continuation of extrapolation and backcasting in exploration of new possibilities
Normative forecasting NF	Extrapolation of needs and goals	Creative setting of new goals and needs and backcasting	na Contiguation of extrapolation and backcasting in setting new needs and goals
Integration (EF+NF)	Extrapolation of existing processes and of existing needs and goals	Creative setting of assumptions on future events and discoveries as well as needs and goals and backcasting	Integration of all

Forecasting, normative OM

Definition

In a normative forecast future tendencies are derived from needs and goals of society and economy.

Functions of human labor OM

Definition

Man is realizing technical and creative functions in his work. Technical functions are the operational, energetic, controlling and logical functions and creative functions are empirical improvements, theoretical analysis and goal setting and invention of new technologies. The operational function can be subdivided into the transport function and the technological function. The technological function is realized by change of the structure or change of the forms. Further distinctions are linked with well-known process classification. Technical functions are more and more substituted by technical means, but at the same time merely created for satisfying higher needs.

Futures research SP See also: Forecast, Delphi technique

Definition

Futures Research encompasses various attempts to develop systematic methodologies to identify future Options (q.v.) or alternatives, or to narrow probabilities of time estimates. See James Bright, ed., *Technological Forecasting for Industry and Government*, (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1968); Cetron and Ralph, *Industrial Applications of Technological Forecasting*, ibid; and H.A. Linstone and M. Turoff. *The Delphi Method: Techniques and Application* Addison-Wesley Publishing Co., Reading, Mass. 1975.

Game theory SP

Definition

Game theory can be defined as the application of mathematical analysis to abstract models of conflict situations. Models can consist of parlor games or situations from the behavioral sciences, including economics, sociology, and political science. Parlor games are generally in "extensive" form, that is, they are specified by a set of rules and are terminated after a finite number of moves. Models from the behavioral sciences are generally in "normalized" form, that is, they are specified by a set of pure strategies which could be followed by suitably instructed neutral observers. Pure strategies are complete lists of choices of legal moves covering all possible responses to legal opposing moves. Due to the enormous number of pure strategies possible in even a relatively simple model, applications of game theory to real-life situations have been severely limited by computational difficulties. However, game theory nonetheless has provided a means for analyzing many problems long of interest to philosophers and behavioral scientists. Of primary interest has been the concept of the welfare state, the theory of monopoly, the concept of the maximum good for the maximum number, and oligopolistic competition.

Genesis of new technologies OM

Definition

Is a process, including various steps at a certain time

- τ_N Arising of a social need
- τ_S Formation of scientific preconditions for satisfying the need
- τ_T Prove of technical feasibility (first technical concept)
- τ_J Invention (First decisive invention)
- τ_K Prove of commercial feasibility
- τ_D Start of industrial development
- τ_{PO} Start of Production in country O

τ_{PJ} Start of production in other countries

τ_Z Reading a share of Z percent in the market.

Global effects SP

Definition

Changes in the climate, habitability, fauna and flora, ocean, atmosphere, land masses, or other large element of the Earth, resulting from human activities. The concept of Global Effects as a subject warranting study emerged from three contemporary developments: (1) the recognition of the Earth as a "spaceship" possessing finite resources and complex natural relationships on which man depends; (2) the increasing power of man's technology; and (3) the increasing rate of diffusion of this technology. Fears have been expressed "of both imminent and potential global environmental catastrophes."

Theories and speculations of the global effects of pollution have included assertions that the buildup of CO_2 from fossil fuel combustion might warm up the planet and cause the polar ice to melt, thus raising the sea level several hundred feet and submerging coastal cities.

Equally foreboding has been the warning of the possibility that particles emitted into the air from industrial, energy, and transportation processes might prevent some sunlight from reaching the Earth's surface, thus lowering global temperature and beginning a new ice age. The U.S. Government has virtually eliminated the use of DDT, largely because of its adverse effects on the reproductive capabilities of birds, and because of its accumulation in other species, including man. Serious questions have been raised about the effects on ocean and terrestrial ecosystems of systematically discharging into the environment such toxic materials as heavy metals, oil, and radioactive substances; or of such nutrients as phosphorus which can overenrich lakes and coastal waters.

Goal OM

Definition

Mental model of the final stage or the direction of a process, which can be influenced or controlled. (Aim, objective, target) A goal is commonly a result of the feedback between needs and resources. Goals can be subdivided into:

long-term and short-term goals,
main goals and auxiliary goals,
general and specified goals
competing and harmonized goals

Hardware SP

Definition

Originally, tools and other household, farm and repair items. With the advent of the computer, the term has come to mean the computer itself and its associated equipment, like control consoles, memory units, key-sort and card-punch equipment, tap tape recording and drive equipment, print-out units, and telecommunications terminal and transmission equipment. Computer hardware is distinguished from the programming procedures used to operate it. These are called "Software" (q.v.).

Heuristics OM

Definition

- Science on problem solving, study of creative procedures
- Recommendations for a selective methodological approach, which is able to give a satisfying result in a rational way, but without guaranteeing it.

Historical taxonomy of innovation OM

See also: Classification of innovations

Definition

Taxonomy of innovations can be made for theoretical and practical purposes. Management and planning of innovations requires a different approach for major and for incremental innovations.

There are two main indicators of an innovation, which can be evaluated roughly in its first stages:

Range of application, and
Scientific-technological level

The range of application is a certain level between quantitative growth of existing demand and change of the whole social system of needs. Scientific-technological level is a stage between quantitative growth of existing technical basis and new basic principles, changing form or structural level of matter.

The seven stages of the Range of Application V_k (k = 0,1,...,6) are:

1. Quantitative growth of existing demand
2. Simple modification of existing demand (improved parameters of existing products or processes)
3. Essential modification of existing demand (new parameters of existing products and processes)
4. Arising of a new demand (new product or process) in the existing demand complex

5. Essential modification of existing demand complex by new products or processes
6. Arising of a new demand complex or subcomplex
7. Change of the whole system of needs.

The seven stages of Scientific-technological level i_k (K = 0,1,...,6) are:

1. Quantitative growth of the existing technical basis
2. Improvement within well-known technical principles
3. As 2. but with essential changes of one factor (material, tool, function, design)
4. As 3. but with essential changes of several factors
5. New solutions within well-known basic principle
6. New basic principle within same form or structural level of matter
7. New basic principle changing form or structural level of matter.

So it can be differed between 7 x 7 = 49 kinds of innovations. Assuming that the importance of innovations w (a coefficient between 1 and 100) follows an exponential function and the two parameters i_k and V_k are connected in a multiplicative form, one can write:

$$w = i_k \cdot V_k$$

$$w = e^{ak} \cdot e^{ek}$$

$$w = e^{(a+b)k}$$

Assuming a symmetric scheme (a=b) one gets

$$w = e^{2ak} \qquad k = 0,1...6$$

According to $1 \leq w \leq 100$ (percent) it follows

$$100 = e^{12a}$$

$$a = \frac{ln\,100}{12} = 0.38376$$

From that the coefficients of importance of each level within the 7 x 7 = 49 field can be found

The assumption of an exponential function is associated with the empirical fact, that the frequency of innovations within a given scale is an exponential function too.

The coefficient of importance w can be multiplied with the speed of an innovation s

$$\text{Speed of an innovation } s = \frac{100}{t_E - t_r}$$

where

t_{ff} = year of first introduction

t_r = year of invention

The product of speed and importance can be called potential of the innovation process

$$p = s \cdot w / 100$$

Holistic SP See also: Synergistic effect

Definition

An approach to research, analysis, or other activities characterized by an emphasis on completeness or wholeness; opposed to the atomistic approach. It is related to the synergistic approach with its emphasis on the organic or functional relationship of the whole to its parts, and on the whole as being greater than the sum of its parts.

Homeostasis SP

Definition

In biological usage, the term refers to a tendency of organisms to maintain uniformity or stability. For example, the human body normally maintains its internal temperature at about 37° C. The term has been applied by analogy to the maintenance by any system of a steady state condition of dynamic equilibrium.

Human capital OM

Definition

The investment in the education and skills of a nation's population. In planned economies a similar indicator is called Educational Funds.

Impact SP

Definition

For one formal statement of the scope of this term, see Environmental Impact Statements. However, the term is far from precise in most usages. The recognition of impacts tends to be a progressive, repetitive process because the impacts on man and his environment from any given technology, process, or system appear to be almost limitless. Some impacts are quantifiable, and some not. Various kinds of impact can have varying de-

grees of directness or remoteness as between cause and effect. The concept of Technology Assessment (q.v.) is the analysis of "total impact."

Incremental (adjective) SP

Definition

Refers to any relatively small, usually positive, change in anything that can be quantified, like a change in temperature caused by a change in applied heat, or a change in demand caused by a change in supply.

In the jargon of public policy analysis, governmental decision making apparently based on little else than a decision to make small yearly across-the-board increases in existing programs is often termed "incrementalism," and is sometimes also disparagingly referred to as the "art of muddling through." However, many social processes show general trends over long periods of time, as, for example, the "secular" trend in reduced purchasing power of any national currency. Incremental adjustments are normally made in response to such secular trends as a matter of course.

Moreover, in any complex social process involving a long learning period (for one example, see Technology Assessment), incremental improvement is inherent and instant perfection improbable.

Indicators of innovations OM

Definition

Innovation is a very complex phenomenon, including all spheres of technological, economic and social activity in the stages from research and development to investment, production and applications. In the early stages there are only two general indicators of innovations which can be evaluated and predicted in very rough variants: The level of technology and the desired range of application. Both indicators are combined into important coefficients. They are connected with the recognized needs, the time factor in connection with the competitive situation and the available resources. The level of technology and the range of application determine the next set of indicators:

- compatibility and interference with existing equipment and skills;
- degree of complexity and complication;
- scale;
- degree of interdependence.

Additional information is needed for these indicators which is not available at the first stages of research and development. With the further progress of the innovation process it becomes possible to calculate:

- the development time;
- the risk factor;
- the lifetime, and

and also to make the indicators already mentioned more precise. Later, the economic benefits and expenditures can be calculated in monetary measures and also other indicators of the economic and social efficiency. However, it is not so easy to isolate the efficiency of the innovation from the efficiency of the production unit which is introducing the new technology because of the interference between the new technology and the existing funds and skills.

What can be done to solve this problem is only a comparison between an innovating unit and a non-innovating unit. However, in this case it is also not possible to isolate two parts of the innovation efficiency:

- the results of the interference with the old funds and skills, and
- the results of the originally new elements.

It is difficult enough to measure efficiency comparing innovation industries or countries of the same social type, but we run into far more problems if we try to measure efficiency of industries or countries in different social systems. The reason for this is the simple fact that the goals and underlying mechanisms of socio-economic actions are different and so is the reference system for measurement of efficiency. If we look at Table 4, one may find that there are no very important differences between market economies and planned economies. But we must make sure that similar indicators are used for different goals in both systems and that in planned economies they are calculated in a unified and partially obligatory way within the planning process connecting all levels from the plant to the national economy.

Table 4. Efficiency measures in market and planned economies

	Level of the firm	National level
Market economies	Growth rates of sales and profits Profit margins (as percent of sales) Earnings per share Return on book value Market share Productivity of labor and capital	Growth rates of national income Labor productivity Balance of current account Capital coefficient
Planned economies	Growth rate of Net product Labor productivity Capital coefficient (output per unit of funds) Return on funds Export profitability Cost factor Material intensity of production	Growth rate of national income Labor productivity Balance of current account Capital coefficient

A common reference system is needed and this is plausible mainly on two levels:

1. In fields of cooperative actions (trade, exchange of technologies, measures for solving world problems).
2. At the level of intermediate goals (productivity, technical level and others).

Some of the innovation indicators have the character of intermediate goals. In Table 5 some innovation indicators for various stages and levels of the Innovation Process are shown.

Industrial structure—indicators

Definition

Indicators of industrial structure on the level of national economy are

- growth rate of industry λ
- productivity level of industry p
- variance of elasticities S_E
  (Elasticity $E = \lambda_i / \lambda$
  λ_i = growth rate of the i-th industry
  λ = growth rate of the whole industry)
- coefficient for satisfaction of social and economic goals g

Growth rate of production and productivity level are well-known indicators. But overall growth rates are only an *indirect* indicator for structural change within a given system. Development is a unity of growth and structural change. But there can be growth without any structural change. Variance of elasticities has not been so much analyzed yet. But it is an important indicator for the negentropy or the order state of the process. The variance of elasticities influences the growth rates in a non-linear way. A high variance of elasticities is an indicator for a high share of push processes and a low variance of elasticities is an indicator for a high share of compensation processes.

Between *push and compensation process* has to be an optimal or at least satisfying relation. And so there must be an optimal or at least satisfying variance of elasticities too.

We think that it is not so easy to estimate and to compare the *progressivity* of industrial structures. But for industrial strategy this question is essential because of the fact that only a progressive structure is able to satisfy most of the goals for industrial policy.

Infant industry OM

Definition

An industry in the implementation stage of the innovation cycle, which is sometimes not able to succeed without protection or subsidies because of strong foreign competition or heavy losses from experiments.

Table 5 Innovation indicators for various stages and levels of the innovation porcess

	National Economy	Industry	Organization	Process
Research	Number of discoveries R&D Expenditure Share of basic research Structure of research	R&D expenditure	Number of R&D personnel R&D expenditure	Degree of complexity
Development	R&D expenditure Number of patents	Number of patents	Number of patents	Scientific, technological level Range of application Risk factor
Investment	Share of expansionary investment	Share of expansionary investments	Share of equipment in investments	Realization time
Production	Share of leading industries	Number and share of new products and processes	Number and share of new products and processes	Costs Economic benefits
Marketing	Diffusion figures of new technologies	Diffusion figures of new technologies	Share of exports	Market period Parameters of technical level and commercial success
Total	Productivity growthe Number of basic innovations	Productivity growthe	Profitability Return on book value	Economic efficiency figures Speed of innovation Potential of an innovation

Infrastructure SP

Definition

Supporting elements. Usually applied in connection with some category of social, economic, or cultural activity. For example, a nation's scientific Infrastructure might be said to include arrangements for financial support of scientific research, basic scientific educational institutions, the manufacture of precision measuring instruments, the management and dissemination of scientific data and information, the organization of scientific societies, and arrangements for interpreting to the public the meaning of scientific achievements.

A nation's technological infrastructure depends on many supporting conditions, including availability of capital, technical knowledge, favorable governmental structure, entrepreneurial attitude, distribution and marketing system, transportation, communications, health services and facilities, education, and many more.

Innovation OP

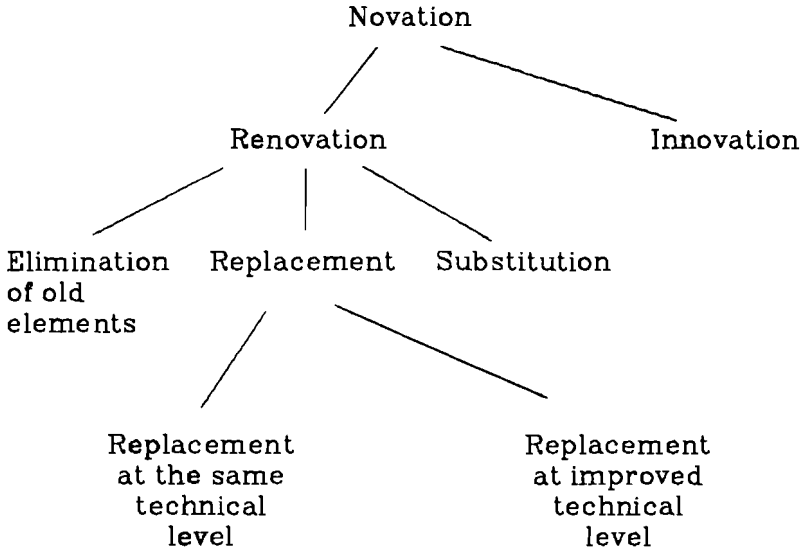
See also:
Innovative process,
Novelty

Definition

Innovation is in general a kind or a result of a development process. In a dialectic sense development is always a certain unity of progressive and regressive tendencies, of renewal and obsolescence, of evolutionary and revolutionary changes. Real innovations mean more than single replacement of old by new elements in a given system. New in the sense of innovation theory is an element or a system, which is more progressive than the old one, that means that it is in accordance with the positive tendency of the development process as a whole.

In this very general connection a statement about innovation is possible only by using a criterion for the novelty and a criterion for the progressivity of the new element or system. It is interesting to mention that these criterions are the fundamental indicators used in patent right over more than hundred of years. Novelty is a continuous and discontinuous phenomenon. Its continuous side is the more or less easy measurable relations of the new element or subsystem to the relevant old element or system. One dimension of this measurement is the time factor (lag or forerun). Its discontinuous side are the qualitative changes, which are not so easy to measure.

Innovation can be derived more generally from innovation. The term innovation (Neuerung) includes renovation or renewal (Erneuerung) and innovation (Neueinfuehrung) and we can give the following classification according to novelty (newness) or to the degree, by which the new element is connected with the old system.



In the strict sense of the word innovation there is no direct relation to the old system, but only an establishing of completely new elements or systems.

In practice the word innovation is not used and the so-called innovations include also renovation processes.

Often a sharp distinction cannot be made. So far as we find more invariances in renovation processes we can assume, that their mathematical modeling is more elaborated than in the case of innovations and this is true indeed.

We have now the possibility to give a general classification of (in)novation processes (Table 6).

There are nine types of renovation between elimination of physically obsolete units without replacement and extension by completely new units. In all these nine cases the progressivity of the existing system can be improved. Thus we have five types of innovation (Neueinfuehrung) overlapping with renovation.

What is the reason for this overlapping? To take as an example, replacement at improved technological level. Introduction of open-end-spinning in a textile mill can be treated as renovation from the standpoint of the existing production system. From the standpoint of the new technological principle it can be treated as a real innovation in the narrow sense of the word. Replacement at improved technological level can also be interpreted as a type of economic obsolescence in such cases, where the technological progress is faster than simple improvement.

The distinction between renovation and innovation is to a certain extent relative. An innovation from the standpoint of one enterprise can be a renovation from the standpoint of the whole branch.

Table 6 Types of change in economic systems according to the criteria novelty and progressivity

	Novelty	Novation		Obsolescence	
	Progressivity	Renovation	Innovation	Physical	Economic
1	Use of existing units until the end of physical life without replacement or modernization			1	3
2	Use of existing units until the end of economic life without replacement or modernization			2	4
3	Elimination of physically obsolete units without replacement	1			
4	Elimination of economically obsolete units without replacement	2			
5	Replacement at the same technological level	3			5
6	Extension at the same technical level	4			6
7	Modernization of existing units	5	10		7
8	Replacement at improved technological level	6	11		8
9	Extension at improved technological level	7	12		9
10	Substitution of old by completely new units	8	13		
11	Extension by completely new units	9	14		
12	Creation of new systems		15		

Innovation decisions OM

Definition

Innovation decisions have certain specific properties, which should be taken into account when a decision support system is prepared.

(a) Decision on innovation can be reversed only with considerable losses of efficiency. The more an innovation advances, the more difficult it becomes to reverse the decision to adopt it because of the manpower involved.

(b) Innovation decisions combine problems of all economic activities of a particular firm, for instance, investment policy, the hiring of manpower, procurement polity, market strategy, etc. DM is subjected to many factors of different quality.

(c) High uncertainties concerning further development of the adopted projects, the future market conditions, etc., complicate decision making. Uncertainties involved in scientific and technological progress are not predictable contrary to the future business environment, which is generally characterized by long-term trends.

(d) Decision makers have to deal with multiple conflicting objectives representing both qualitative and quantitative business aspects. Measurement in terms of corresponding scales combines objective and subjective elements. The importance of experience represented in the firm of judgments cannot be overemphasized. The evaluation of alternatives in terms of the objectives can change rapidly as a result of unforeseen events.

(e) Innovations are created not by chemical reactions but by people. The people involved (decision makers, R&D specialists, workers) form groups with their own goals, which may differ considerably. In order to be successful, management must create an atmosphere of commitment for the eventually selected projects and weigh the interests of all groups.

(f) Innovation projects extend over about 3-7 years (in the firm under consideration). The innovation process includes all steps beginning with proposals and ending with the implementation of a certain product or process. (The methodology developed in this paper does not consider explicitly steps proceeding project proposals and following implementation). Hence, decision making or innovations is dynamic and multistage in nature. All stages have special problems and their own sources of uncertainty. Responsibility alters in accordance with the stage attained. A lot of partial decisions have to be taken in the iterative process of decision making during the development of a certain project. The understanding both of the feasible set of alternatives and the aspiration level of the objectives can be subjected to considerable change.

(g) Decisions on innovation projects have to be taken within a certain time period, sometimes rather quickly. Thus, we have to deal with a situation in which decisions are made sequentially in time; the task specifications may change over time, either independently or as a result of previous decisions; information available for later decisions may be contingent upon the outcomes of earlier decisions; and implications of any decision may reach into the future.

Innovation functions OM

Definition

Various mathematical functions can be used for describing renovation and/or innovation. Examples can be found in

Diffusion theory
Saturation processes
Learning curves
Life curves
Life expectancy
Replacement distribution
Substitution theory
Efficiency cycle and change

One can systematize all these fields under mathematical aspects in the following way:

1. Limit-oriented development (empirical or theoretical limit K). This includes diffusion, saturation, learning, substitution.
2. Optimizable development with the extremum y_{max} or y_{min} This includes life curves and similar patterns.
3. Cyclical component of a given development. C(t). This includes all kinds of waves, seasonal movements, periodical deviations.

Innovation policy OM

Definition

All industrial countries have a wide variety of policies for the stimulation of industrial innovation with many new measures adopted only in the past ten years. This is particularly true of specific direct aid to enterprises and fiscal incentives to enterprises. Remarkable is the extent to which countries, which normally shared an active interventionist role of government policies, have nonetheless recently adopted new policies and started new programs which undoubtedly enhance the role of public policy in relation to industrial innovation. This indicates how crucial the innovations became for the governmental policy and reflect the fact that the management of government more and more recognize the challenge from new resources situation which implied a lot of social problems on the national and global problems to the innovations activities. The old emphasis on "science" policy is increasingly related to technology and to industry and more and more countries adopted some measures of direct aid to industry in the field of innovations. They are aware that it is increasingly difficult to permit this strategic variable to be given over to uncontrolled market forces.

But the experience of management of innovations in several countries has also shown that simply to spend more money on R&D cannot in itself ensure success, and may in indeed make failure more likely. A whole series of innovation studies have demonstrated that the most common causes of failure are not those associated with lack of finance for development, but hose related to a poor understanding of the market, to a gap of information about successful innovation fields and failure to relate technical development to the needs of potential

users and coming shortages in the resources situation. This indicates that government policy to stimulate industrial innovation have to have a well conceived combination of procurement policies and R&D subsidy policies. There are a wide variety of measures which government can adopt to improve the capability of firms to innovate. The governments policy to try to stimulate one or other of the innovation stages (invention, prototype and development, technical and commercial feasibility studies, production), or the transition from one to another, within an enterprise. There are:

- measures for aiding inventions (whether classified as "specific" measures or as "climate" measures);
- measures for directly financing R&D in an enterprise with the object of stimulating scientific and technological creativity by supporting projects planned by the enterprise;
- "major programs";
- measures for preparing the most environments of innovations;
- measures for ensuring the transfer of technology and knowledge from government laboratories to industry or between industries;
- measures for making certain research capacity available to industry.

Innovation process OM See also: Innovation phases of the innovaton process and stages of the decision process

Definition

Innovative process is the sequence

- Perception of a problem or opportunity
- First conception of an original idea
- Research and Development
- First introduction into production and market
- Application and diffusion
- Improvements and incremental changes.

There need not be a straightforward running through of one innovative activity after the foregoing one. There may be breaks and lags in time, and there may be several of these activities— related to the same technology—which are performed simultaneously. In particular, research and development—even basic research—may be carried on after a the technology has been applied for many years. Pharmacy is a typical example for new products which are known to be effective but where it is often unknown or uncertain why they work.

Innovative system OM

Definition

Innovation is actually a change in the technological system withe a great impact on the given economic system or subsystem. Therefore in Figure ee we devised a scheme with three levels, which represent subsystems of the innovative system.

The first level is the innovator, that is the person or group of persons who carry on activities in research, development, application and exploitation. The second level is the organization in which the innovator is carrying on his activities, and the third level is the social, economic, and political environment of the organization. The term environment is of course here too general and needs some explanation.

In planned or market economies there is no simple selection environment in the biological sense of the word. An economic environment is hierarchically structured and consists of at least two levels which have their own laws and regularities. The microeconomic and macroeconomic levels must be linked not by extending the laws of one level to the other one, but by studying their interaction. The economic environment for innovations is an operational or policy environment which very much depends on the actions which are taken on the national level and this is not only true for planned economies.

In a very general sense a system is a set of elements between which relationships exist. These relationships may be either of a structural nature, framing the system, or they may be actually taking shape in the system and therefore shall be called process variables. Combining the concept of three levels with the definition of the system, we get a matrix (Table 7) of nine cells.

Table 7. Innovative system

Levels	Elements	Variables related to Structure	Process
Innovator	a) Input, output	b) Interplay of innovative persons	* Innovative activities
Organization	c) Resources needs	d) Organizational structure	e) Organizational measures
Environment	f) Resources needs	g) Environmental structure	h) Environmental measures

* The variables (a)-(h) are influencing factors of the innovative activities.

Integrated technological basis of a developing country OM See also: Appropriate technology

Definition

Technological basis of developing countries should include hard and soft, large and small, high and low technologies in appropriate proportions in order to be able to improve the economic efficiency of the countries and help them use the benefits of the international division of labor.

Unless integrated into a mixture of different types and levels of technology in a concept of the development of national technology basis, low cost labor intensive technologies would only be another term for low labor productivity and low standards of living. This would mean recommending underdeveloped technologies to underdeveloped countries.

It poses a great challenge to the developing country to develop their own scientific and technical basis and to take part in world-wide scientific-technological progress. The developing countries can only avoid deterioration of their present condition by establishing their own national systems of division of labor, organized to help them use their own resources to gain equal rights in the international division of labor.

The main concern at present of government technology policy must be the stimulation of flow of labor from a and b technologies (small scale production on a manual basis), to the c and d technologies (large scale production on a technologically advanced basis). The a and b technologies must be strongly coupled to the c and d technologies. Conservation of the "dual economy" in the developing countries will not help them solve their problems. Means of attaining integrated development include the following:

1. For domestic industry (on the c and d technology level) to develop and produce appropriate technology and equipment for a and b sectors of national economy.
2. Social innovations for new organizational forms of small scale production and productive cooperation between social scale production units and large scale factories.
3. Development of education system and eliminating illiteracy. Generally the educational system needs to be made more production oriented. Such educational innovation is crucial, because the old educational systems, whose main aim was conservation of the traditional social structures are to a large extent consumption oriented and incapable of preparing the new generation to cope with the problems resulting from the process of industrialization and from global development.
4. To support the small scale, labor intensive, export oriented sectors and to stimulate selective export lines based on large scale production.
5. To establish technological consulting points and service feasibilities (especially for agriculture and handicrafts).
6. To step up the R&D expenditure for technological development of small scale industry.
7. To promote stimulation measures for the technical development of final scale industry through brokerages, credit, guaranteed markets, etc.

These measures aim to integrate small scale production into the national socio-economic and technological basis. Only through integrated development can

national natural and human resources be effectively employed to attain the economic growth needed to meet the needs of the population.

Developing country planners must seek a combination of different technological levels which will lead to well proportioned development of the technical basis. This combination could have the following features:

1. Use of surplus manpower for the production of labor intensive production means.
2. Concentration on the import of advanced technology (level c and d) on key operations of the core processes. There the processes should be based on labor intensive technologies.
3. Use of the limited stock of advanced equipment for demonstration and education.
4. Transposition of old production means to small scale firms.
5. Promotion of high standards of quality strategy in means of production.
6. Establishment of a closed technological cycle from raw materials to final products on the basis of national division of labor.
7. Avoidance of nonintegrated investments and technological conservatism.

Technology transfer could help the developing countries cope with their problems. This technology transfer includes:

- hardware supply (equipment),
- installation and operation of new technology (software),
- organization for efficient management of technology (orgware).

The transfer of hardware is much easier than transfer of software and hardware, which is socially and culturally specific, and often cannot be made without social, economic and cultural changes. The change in the system of cultural and social values depends on the strength of the social forces which effect it. The developing countries presently pay dearly for technology transfer (more than 15% of the net proceeds from exports), but the results of this transfer have not helped to solve the serious problems of these countries. Reasons vary—the most important are the social forms in which this transfer is taking place, the inappropriate character of the transferred technology, and the social conditions in some of the developing countries which make them unable to absorb new technologies. Two key measures for the better use of technology transfer for national national needs include:

1. Insurance that the transferred technology can be integrated into the national system of division of labor;
2. Creation of a scientific-technical basis which can effectively absorb the transferred technology.

Intermediate technology OM See also: Appropriate technology

Definition

A concept of a level of technology intermediate in development between the first primitive means of accomplishing a purpose and a means employing an advanced, capital-intensive economy of scale.

Invention OM See also: Innovation, Novelty

Definition

Creation of an idea, which is both new and useful. Discovery of an accordance between a need and a technological opportunity, which results from certain properties and parameters of matter.

Inventions can range from the novel combination of known elements to the conception of an altogether novel principle. however, the term is not commonly applied to the creation of a large system (such as satellite communications systems or air defense systems) although these may incorporate applications of a number of inventions.

Irreversibility SP

Definition

A one-way process, or alternatively a process that can be reversed only with great difficulty. An illustration is the comment by Oscar Wilde on viewing Niagara Falls. He agreed that it was a remarkable sight, but that it would be even more remarkable if it went the other way. An example of irreversibility in the physical world would be a wet chemical reaction in which one of the products was removed from the solution, as either a precipitate or a gas.

One concept of irreversibility relates it to Entropy(q.v.). Every closed system tends to run down. In this sense, irreversibility is a quality inherent in closed systems found in nature.

In the narrower sense of social use of technology, irreversibility is found in the growing commitment or dependency of a social system or subsystem on a particular artifact or assortment of technological artifacts—pesticides, automobiles, telephones, drugs, vaccination, etc. Other irreversible effects are those related to the consumption of fossil fuels, or the extraction and use of minerals from concentrations in nature that result in their unrecoverable dispersal. For example, the making of graphite from petroleum, or the use of cobalt salts to make paint driers. Although irreversible effects are inherent in natural systems, the rate at which they occur is partially determined by human decisions.

The concept of irreversibility may depend primarily on the factor of time. For example, a catastrophic, large-scale generation of radio-activity might cause a train of events that could not be reversed in time to prevent permanent damage to man's environment.

One respondent comments: "Most situations that one would judge to be irreversible are so not because of physical barriers but owing to the magnitude of cost attached to reversal. This is particularly true of the commitment of social systems to given technologies."

Know-how SP

Definition

Specialized technological knowledge. Knowledge, faculty, or skill in the accomplishing of a technical or industrial operation.

Lagging industries SP

Definition

(see also Technological Lay and Technological Gaps) An imprecise term conveying a sense of non-progress or level of performance, as measured by some parameter or set of parameters, below that of some referent industry or group of industries.

Lead time SP

Definition

Lead time is the time between two implicitly or explicitly designated events, the second one generally being an objective or goal. In research and development, lead time usually refers to the time between the beginning of a project, like the commitment of funds to develop an airplane, and the project's successful completion, which may be when a successful prototype flies or when new planes are in mass production. However, the term has come to be applied widely to any preparatory period, decision sequence, or time lag between signal and response. In concept, the term derives from an analogy with sports –the throwing of a ball to "lead" the running receiver, or aiming a shortgun in advance of a flying bird. The PERT (q.v.) concept links the sequence of events in a process with time lines, with the length of each line proportional the length of time (lead time) required to complete or prepare for the event that follows it. One respondent suggests that lead-time in system development encompasses "start-up time" and "pipeline time," both related to the time needed to train skilled manpower to operate the system.

Levels of technology OM

Definition

The Table 8 shows us the different technological levels which exist in each country. In all countries lower level systems a to c exist side by side. But in the industrialized countries the production volume of a and b technology is very low and the different technological level function as parts of an integrated national economy.

Table 8. Levels of technology

Level	Content	Example
a Technology	Manual drive, task execution, control and logical functions	1. Drop spindle 2. Spinning wheel 3. Improved spinning wheel
b Technology	Substitution of mechanical for human energy (power tools)	Spinning wheels withe external drive power
c Technology	Substitution of the mechanical for human energy and task execution	1. Selfactor 2. Ring machine 3. Open-end spinning

Material (noun) SP

Definition

The difficulty in defining this word is in determining, what to exclude. One common meaning is: "A solid substance having a certain degree of permanence and intended either alone or combined with other objects, for well-specified uses." This definition is defective on many counts; it excludes liquids and gases, in which forms many useful industrial materials appear. Another defect is in the implicit assumption that a material must have present utility. The implication of this assumption is that a substance may be converted by technology from a non-material to a material, and then later be converted back into a non-material again. Another awkward complication is presented by the notion that a substance ceases to be a material when it is changed by processing.

For public policy purposes, Title II of Public Law 91-512, the Resource Recovery Act of 1970 (Title II bearing the separate title of "National Materials Policy Act of 1970"), defines (section 205) materials as "natural resources intended to be utilized by industry for the production of goods, with the exclusion of food." The exclusion of food in this case is arbitrary and functional, rather than logical.

It is suggested that in the modern sense of addressing the "Material Cycle" (q.v.) it is necessary to use a definition as all-encompassing as possible. Thus, materials are stuff that things are made of or with or could be. It includes bothe materials as they occur in nature and in other useful forms; it encompasses both materials in the (relatively) pure form and in their infinity of combination.

Converting a substance or combination of substances into a useful shape does not take away its existence as a material; a razor blade is also a piece of stainless steel , a piece of material, whether it is in use or after it has been discarded. It is of no matter whether the material is in the form of a solid, liquid, or a gas, it is still a material. Wood, when cut into lumber, pulped to make paper, or disintegrated into sawdust, does not lose its character as a "material."

One definition proposes a distinction between a substance (like iron or copper) and a material (like steel or brass).

Another recognizes that the use may determine whether a stuff like sawdust is a material (for use in making fiberboard) or a fuel (to be burnt).

The definition at the beginning of this discussion excludes a gas like nitrogen, useful in processing nickel concentrates and as an alloying additive in stainless steel. It excludes a liquid metal like gallium or mercury. It excludes materials used as ablating nose cones for reentry vehicles. However, the main thrust of the definition warrants attention in that it seeks to combine the idea of a substance and the idea of its use.

A current attempt to define "Material" functionally for legislative purposes distinguishes fuels from materials in the following way:

> Materials means natural resources intended to be utilized by industry in the production of goods, with the exclusion of food and of energy fuels used as such.

Materials cycle SP

Definition

All materials employed by man move in a "total materials cycle." From the earth and its atmosphere may takes ores, hydrocarbons, wood, oxygen, and other substances in crude form and extracts, refines, purifies, and converts them into simple metals, chemicals, and other basic raw materials. He modifies these raw materials to form alloys, ceramics, electronic materials, polymers, composites, and other compositions to meet performance requirements and from them makes shapes or parts for assembly into products. When its useful life is ended, the product returns to the earthe as waste; or it may be dismantled to recover basic materials that reenter the cycle.

Implicit in the operation of the total materials cycle are strong three-way interactions among materials, the environment, and energy supply and demand. The condition of the environment depends in large degree on how carefully man moves materials through the cycle, at each stage of which impacts occur. As materials traverse the cycle they may represent an investment of energy in the sense that the energy expended to extract a metal from ore, or to reduce aluminum from its oxide, need not be expended again if the metal is recycled. Compare Closed Cycle.

Materials management SP

Definition

Materials management is the application of scientific and technological principles and training to achieve the optimal usage of materials resources. It is a broad concept, not only because of the scope of the meaning of materials (see Material), but also because it encompasses all aspects of materials extraction, processing, utilization, marketing, disposal, and reuse. It thus includes such concepts as Resource recovery (q.v.) and Recycling (q.v.), which represent specific management approaches to materials conservation and use. Traditionally considered more narrowly as the manipulation of materials by business and industry, it has come to include also the effect of materials use on society and the consequence of such use. Thus, it relies heavily upon the application of System(s+ analysis (q.v.) to achieve an optimal mix of various scientific technological, economic, social, ethical, and political factors which impinge on the development and use of material resources for the good of society as a whole. Increasingly, a primary objective of materials management is the achievement, insofar as practicable, of a Closed Cycle (q.v.) for materials (i.e., low Entrophy (q.v.) to ensure that maximum benefit is obtained from materials at minimum overall cost.

MBO SP
(Management by objectives)

Definition

Management by Objectives, a term attributed to Peter F. Drucker is a method of managing "by which members of an organization jointly establish its goals."

> Each member, with assistance from his superior, defines his area of responsibility; sets objectives that clearly state the results expected of him; and develops performance measures that can be used as guides for managing his unit and that will serve as standards for evaluating his contribution to the organization. There are four basic components of the MBO system: setting objectives, developing action plans, conducting periodic reviews, and appraising the annual performance.

The organizational benefits of MBO are claimed to be improved management performance, planning, coordination, control, flexibility, superior-subordinate relationships, and personal development.

Drucker characterizes MBO as a philosophy of management which:

> rests on an analysis of the specific needs of the management group and the obstacles it faces. It rests on a concept of human action, behavior, and motivation. Finally, it applies to every manager, whatever his level and function, and to any organization whether large or small. It ensures performance by converting objective needs into personal goals.

A recent article in *Public Administration Review* discusses public sector MBO and PPBS and provides the following comparison of the major features of the two management techniques:

> [C]omparing MBO and PPB is like comparing apples with oranges. The two entities are not viewed strictly as alternative management systems. Rather, they have a somewhat different focus and tend to exist in different organizational environments. In particular, PPB is primarily viewed as a system for conceiving, developing, and costing new policy thrusts and is located organizationally near

the top of large, sprawling bureaucracies. MBO conversely, is appropriate at any organizational level and is basically a tool for monitoring ongoing programs. The distinction however is very ill-defined; for in MBO the process of deciding what one's objectives for the future will be must certainly relate very closely to the choice of new policies and programs. PPB on the other hand cannot function in an operational vacuum but must at least monitor, if not motivate, the accomplishment of ongoing programs as a means for refining the basis of continuing analysis. Also, as evidenced by the recent MBO efforts in the Office of Management and Budget, the two systems will at times be superimposed upon one another, will follow one another in succession, or may in fact exist side by side.

SUMMARY OF FEATURES

NMO	PPB
Makes objectives explicit; recognizes multi-objective situation	Projects requirements and resource implications in future years.
Identifies conflicting objectives	Emphasizes analysis of alternatives
Provides for participative management	Utilizes analytical expertise
Ensures a control mechanism by providing for feedback and measurement of accomplishment	Provides for detailed costing of selected alternatives
Fosters managerial acceptance of responsibility and evaluation of managers by results	Encompasses exhaustive and mutually exclusive program structure
Encompasses little formal administrative machinery	Utilizes numerous decision documents

Means OM

Definition

All resources, available to an operating subject for a desired end.

Mission SP

Definition

A single large operation or task, or a continuing specific function. Examples of missions might include the construction of a number of housing units, capture of a hill, development of a prototype fast breeder reactor, maintenance of national air superiority, achievement of improved pollution control or automobile safety. A distinction may be made between an agency of government that performs a continuous or repetitive function such as budgetary control or revenue administration, and an agency responsible for carrying out some one of the missions listed. The latter might be called a "Mission Agency" but probably not the former. Mission Research is a term with several possible alternative

meanings: it encompasses exploratory research, supplied research, and supporting research to advance the general capability of a Mission Agency to perform- and also research of these types in support of a specific task or mission as more narrowly defined. It is with respect to the latter type that the study, Project Hindsight, was addressed.

Model SP

Definition

As used in science policy literature, the word signifies a simplified description of a process, or system, or the interaction of either with its environment. Usually a model is expressed in quantitative terms so that it can be exercised mathematically. A non mathematical model is sometimes called a Paradigm (q.v.).

With respect to the science policy meaning of the word, a respondent notes: "An important thing about the model is that you try to walk the very fine line between shoving in too much detail (and then you can't use the model in practice) and leaving out essential details (in which case it will lead you astray)."

There are also two older meanings of the word Model: (1) a typical unit (e.g., late-model automobile), and (2) a reduced-scale structure to test performance or other characteristics of a design before going to full-scale prototype construction. From the second meaning is also derived the idea of a "scale model"—a reduced-size simulation of a structure that may or may not be operational.

A British commentator suggests that the Glossary should call attention to the existence of a taxonomy of models, that includes: structural, dynamic decision, analog, deterministic, and stochastic. However, the important point in all of these is the simplified representational feature.

Modernization OM

Definition

The installation of technologically advanced machinery in place of old machinery. Construction measures normally require not more than twenty or twenty-five percents of the modernization capital.

Industrial plants have a certain life cycle, which is including the phases

- Installation
- Learning period until the planned efficiency is achieved
- Improvements
- First local modernization in one department
- Improvements
- Second local modernization . . .
- Total modernization

— Improvements and so forth.

Morphological analysis OM

Definition

Description of the whole range of possible solutions for a given problem.

Sequence:

— definition of a problem
— description of all thinkable properties to the problem
— Distinction between variants of properties described in a first morphological table
— Marking the most interesting elements in the morphological table
— Choice of possible solutions by connecting those elements

Multinational corporation SP

Definition

Although there is no agreed definition of the term "multinational corporation," it may be defined simply as a business enterprise conducting transnational operations in two or more countries.

> Some authorities define it as a company whose foreign sales have reached a ratio of, say, 25% (or some other share) of total sales. Some find the definition in organization; i.e., a company that has global product divisions rather than an international division. Others look to the distribution of ownership or to the nationality mix of managers or directors as the determining characteristic. Professor Raymond Vernon of Harvard University, an authority on the multinational corporation, regards it as a company that attempts to carry out its activities on an international scale, as though there were no national boundaries, on the basis of a common strategy directed from a corporate center. According to Vernon, affiliates are locked together in an integrated process and their policies are determined by the corporate center in terms of decisions relating to production, plant location, product mix, marketing, financing, etc. Mr. Jaques Maisonrouge, President of IBM World Trade Corporation,

Some reasons often given for U.S. firms becoming multinational corporations are:

- To cut the shipping time for products with short shelf lives;
- To manufacture to special market requirements (smaller appliances, differing electrical requirements, and the like);
- To be as close as possible to the customer to adapt to his needs and provide fast service;
- To meet a government's purchasing policies by being within the country's borders;
- To avoid the problems imposed by frequent strikes at U.S. ports;

- To keep foreign firms so busy competing locally that they cannot effectively launch export campaigns aimed at the U.S;
- To be close to raw materials sources; and
- To meet foreign "minimum local content" requirements.

The number of U.S. multinational corporations ranges from 75 to more than 3,000, depending upon how they are defined. The Harvard School of Business Administration in its studies of U.S. multinational corporations, which comprise about two-thirds of the world's total has taken the firms listed in the Fortune group of the largest firms and selected those having equity interests of 25 percent or more in manufacturing enterprises located in six or more foreign countries. The 187 firms that qualified under this definition were studied extensively and account for about three-fourths of all U.S. foreign direct investments. Among these are such familiar names as General Motors, Chrysler, Ford, Singer, ESSO, and ITT. In addition, about another 100 foreign firms comprise the major multinationals based in other countries, including such companies as Nestle, Shell, and Unilever (Lever Brothers).

Multinational corporations are among the world's giant firms; annual sales of at least $100 million are considered a minimum size for a multinational.

According to 1970 figures, General Motors ranks 23, Standard Oil (N.J.) ranks 27, and Ford Motors ranks 29 in a listing of countries and multinational corporations by the corporations' gross annual sales and the countries' gross national products.

National wealth OM

Definition

The aggregate value of all the tangible assets of a country, existing in the production sphere, the service sector, the households and in the national environment. This measure could be very important for calculating the social effectiveness of innovations in economic terms, including their primary and secondary social consequences. But a linkage between the national wealth concept and technology assessment does not exist yet.

Natural resource SP

Definition

Any of the main fold raw materials and wildlife available in nature for man's use, including minerals, forests, water, fish, fowl, air.

Need OM

Definition

Socially determined desire for acquisition of material or ideal goods or gap between the ideal of a process and its present state. There exists a hierarchy of social needs from food, dressing, housing, transportation to education and creative self-fulfillment.

Net energy analysis SP

Definition

In addition to land, labor, and capital (the commonly costed factors of production), it takes energy to produce energy. Net Energy may be defined as the amount remaining for consumption after the portion required for exploration, production, upgrading, and delivery has been subtracted from the total energy initially available in a specified system.

Net Energy Analysis is an evolving system of analysis currently being investigated and applied by, for example, the National Science Foundation, the Department of Energy, and the Department of the Interior, to evaluate better the real energy costs of developing and using various energy sources. Energy itself is the parameter used to using various energy sources. Energy itself is the parameter used to measure impacts in this method. "Since energy is the one commodity present in all processes and since there is no substitute for it, using energy as the physical measure of environmental and social impacts, of material, capital, and manpower requirements, and of reserve quantities reduces the need to compare or add 'apples and oranges.'"

Net Energy Analysis may prove to be a useful decision-making tool for public policy analysis.

NIH (Not Invented Here) syndrome SP

Definition

The "not invented here" syndrome is alleged to be a characteristic of research and development. Its major symptom is a lack of interest by professionals in new ideas which have originated outside of their establishment, or perhaps even in another division of their establishment.

The NIH syndrome may be considered an organizational pathology, prevalent at both the research and management levels, which impedes communication (q.v.), innovation (q.v.), and technology transfer (q.v.). It is caused by a conviction, based on institutional pride or confidence, that "if it were any good we would have thought of it first."

Norm SP

Definition

A standard or median: expected or average behavior; somewhat synonymous with normal.

Normative SP

Definition

This important adjective encompasses all non-quantifiable values, value orientations, and value-motivated activities. In contradistinction to the scientific method, which aspires to be value-free, any normative procedure or activity concentrates on the assigning of social values. It is the distinction made by Hume between "is" and "ought." Thus, normative forecasting of technology represents an attempt to identify what kinds of innovation will be needed (i.e., what society) will desire or ought to have) some future date. Normative analysis attempts to determine what is good or bad; science characterizes what happens and why. (See Forecasting, Normative.)

Objective (noun) SP

Definition

An end or goal toward which efforts are directed.

Obsolescence OM

Definition

The shortening of the life of a product or an asset, such as a plant, machine or piece of equipment because of the fact that

a. the same type of asset of now produced much cheaper or

b. the same type of asset is now under more productive than before.

Obsolescence is caused by technological progress.

Real life time of assets or products is therefore a good measure for the innovation process in an industry.

Obstacles to creativity OM

Definition

Human creativity is the most decisive productivity source, but at the same time the most wasted resource. Obstacles to creativity occur in the three stages:

- Formation of creative personalities,
- Creation period, and
- realization period; and four levels
- Growth of productive forces,
- economic relations and interests,
- institutions, and
- mental and ideological factors.

Among others we find the following obstacles:

1. Nutritional deficiencies
2. No economic interest in formation of creative personalities.
3. Insufficient educational system, illiteracy.
4. Elitist theories and ideologies. Ignorance about creativity.
5. Unsatisfactory material conditions. Too little free time.
6. Economic incentives leading to brain drain. Economic conditions leading to frustration. Unemployment.
7. Socially anticreative goals and tasks of institutions. Organizations in the saturation stage.
8. Attitudes against creative people. Uncreative atmosphere. Anxiety about the future. Alienation.
9. Material constraints for realization.
10. Not enough incentives for the innovation. Too narrow division of labor. Unemployment.
11. Institutions inhibiting innovation.
12. No understanding between R&D and production.

Operating costs OM

Definition

Costs in a definite period of a production stage in an enterprise or department minus the materials from outside.

Option(s) SP

Definition

A choice among alternatives. In Technology Assessment, Policy Analysis, and PPBS (q.v.) such options are characterized as fully as possible in quantitative terms—as to their costs and benefits, including important second-order consequences—in order to establish a basis to aid in making rational management decisions

A respondent suggests that too much stress may here be put on the quantitative aspect of Option Analysis (q.v.). Some technical issues defy quantification, such as for example, how much resources to devote to basic research or how to allocate between two claimant disciplines. Moreover, options may involve normative values that are not subject to quantification at all, yet may be brought into the assessment process, such as for example, impairment of scenic values, public apprehension of physical hazard, or convenience of the consumer.

Paradigm SP

Definition

A set of relationships like a model, but more abstract and less quantitatively defined than a model. Thomas Kuhn defines paradigms as "universally recognized scientific achievements that for a time provide model problems and solutions to a community of practitioners." Ayres defines it as "a structured set of axioms, assumptions, concepts, hypotheses, models, and theories, e.g., Newtonian physics or Marxist economics."

Parameter(s) SP

Definition

A quantity or characteristic having fixed values for a particular subject for separately indicated cases or conditions. For example, the strength or resistance to failure of a given material (one parameter) will vary according to temperature (another parameter). The information can be presented in the form of either a table or a curve.

Mathematically speaking, parameters are those factors, generally variables, which together represent or approximate the nature, functioning, or behavior of a system.

Parameters are generally quantifiable and, when quantified, subject to mathematical formulation. However, the term may be loosely applied to factors which are not readily subject to mathematical operations. For example, parameters required to predict the outcomes of elections may include numbers of registered voters, partly affiliations, past voter turn-outs, voter attitudes, expected impacts or major issues, and expected impacts of major interest groups, several of which are non-exclusive and non-quantifiable.

When parameters are quantifiable, or at least subject to analysis in qualitative form (like "popular" or "unpopular" candidates or "important" or

"unimportant" issues), but not reducible to mathematical formulation (that is, not reducible to a statement of equality or nonequality), they may be analyzed in other ways. Such "Parametric" analyses include rank orderings, frequency distributions, graphic analyses, Cross Impact Matrix Analyses (q.v.), Algorithms (q.v.), Delphi Methods (q.v.), and heuristic modeling.

For a discussion of analysis conducted on the basis of unquantifiable parameters, but known mathematical relationships, see Parametric Analysis.

Period of a cycle OM

Definition

Time length of a cycle, for example

- fashion cycle 1-2 years
- Market cycle of durable consumer goods 3-5 years
- Innovation cycle (Major innovations) 5-20 years
- Educational cycle 15-25 years
- Cycle in the exploitation of natural resources 50- 150 years

Phases of the inovation process and stages of the decision OM

Definition

Innovation process can be subdivided into six main steps:

- preparation
- research and development
- investment
- production
- market penetration
- run out.

Generally we have to distinguish between three stages, invention, technical realization, and commercialization. These steps are interconnected, often they overlap and only three of them (preparation, production and run out) are inevitable. The time characteristic of the innovation process in general is well-known, but from the point of view of management it is necessary to analyze the whole innovation process under the requirements and opportunities for decision-making. Therefore one can combine in two dimensions, the steps of the innovation process and the stages of the decision process. By this kind of investigation one can identify the main delays according to both dimensions.

Planned obsolescence SP

Definition

Yearly or other periodic changes in the styling or design of products that induce consumers to buy new items before old ones have been worn out. This approach is closely connected with the appearance of pseudo-innovations, which waste resources and bring not real effects for the user.

Policy (collective noun, also policies) SP

Definition

A general course or method of operation adopted or proposed for the achievement or maintenance of a condition or (less frequently) the winning of an objective or for the minimization of error in the purposeful control of future events. The term is customarily employed with respect to social, public, administrative, and business institutions, and particularly to characterize the general principles guiding the operational decisions of their principal executives, to achieve coherence and consistency of management.

Policy meansintelligently directed action toward consciously determined goals—as distinct from aimless drift and blind faith.

An administrative hierarchy of procedures can be identified. It begins with Policy (as defined above), leading to Program ("an ordered set of interrelated actions"). Program, in turn, may be further subdivided into Products or tasks, each contributing coherently to a Program in support of a Policy.

Possibility OM

Definition

Inner tendency in a chain of events, which leads to certain results under certain conditions.

Prediction SP

Definition

Loosely, synonymous with Forecast (q.v.). Properly distinguished from it in that Prediction is a declaration (a non-probabilistic statement at an absolute confidence level) that some specified event will occur at a specified future point in time, or within some time period.

Priorities SP

Definition

Any systematic methodology to put first things first. It is the systematic application of pertinent criteria to a set of Options (q.v.) in order to rank the options in a rational order of preference as claimants for a limiting resource. The limiting resource can be time, management attention, dollars, manpower, or other. The implication of a priority system is that not all programs can be undertaken at once, or with the same degree of completeness or expenditure of resources, and that therefore the resources must be reserved (allocated) in accordance with a set of rationally-determined preferences.

A distinction should be made between program priorities and normative priorities. In the former, the limiting resource is material and quantitative; in the latter it may be a finding based on social attitudes. Ultimately, of course, physical limitations will prevail, even if they are insufficiently appreciated by society. Thus--

> Calling for a reallocation of national priorities is now a standard theme in the rhetoric of both the establishment and the student activists. What is often forgotten is that the term "priority" implies a choice. To have more of one thing, we must give up something else. If we could achieve all our objectives simultaneously, there would be no need to set priorities, no need to make difficult choices, Reallocating national priorities, therefore, is a double-edged concept—it not only involves a decision about what we want most, it also involves a decision about what we want least.

Much of the discussion in the area of Science Policy revolves around the issues of how much money should be provided for supporting research and development and how the total pie should be divided among the various disciplines and subject areas of science and technology. The search for improved criteria and an improved methodology to apply to this allocation problem is an important area of science policy research.

Probabilistic situation OM

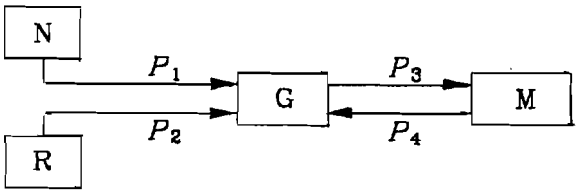
Definition

Situation, which can be realized by statistical, stochastic, strategic, heuristic gaming methods in order to predict its possible future. It cannot be described by simple deterministic methods.

Problem OM See also: Task, Goal, Means, Need, Resources

Definition

Difference between an existing and an desired effect or between the present situation and certain objectives, which cannot be closed by using a known algorithm. There exist four problem levels or trade-offs between needs N and resources R, goals G and means M.



P_1 Problems of need assessment and goal definition

P_2 Problems of resource assessment and goal definition

P_3 Search for means under given objectives

P_4 Search for goals under given means.

Procedure OM

Definition

In a procedure an input J is transformed into an output O with a transition probability p. Three types of such processes exist:

a) p = 1 is realized by determinated algorithms (see also Algorithm)

b) p = 1 is sometimes realized by heuristic algorithms, if they exist and if they are more economically than determinated algorithms. (see also Algorithm, Heuristic)

c) c < 1 is realized by Heuristics (see also Heuristic).

Productivity growth and innovation OM

Definition

One of the most important intermediate goals in market economies as well as in planned economies is productivity. It is widely accepted that productivity growth rates over a longer period reflect the true economic performance of a country or an industry. The data on productivity growth are available in all countries and they are more comparable than profitability ratios. But we have also to take into account the constraints which are connected with this indicator.

$$Labor\ productivity = \frac{Gross\ product}{Number\ of\ employees}\ or\ \frac{Net\ product}{Working\ hours}$$

If we look more into statistical details we find that the gross domestic product is not the same in the OECD* and the CMEA** countries. Material input from outside the firm is not included in OECD countries but it is included in CMEA countries. On the other hand, the figures of the CMEA countries include only goods and so-called productive services, but not banking or insurance operations, rent, and other similar factors.

Industrial productivity growth remains the main source for national welfare, international competitiveness and overcoming gaps in resources. It is important for the less developed as well as for the advanced countries. Planned economies have a goal to reduce the productivity gap in order to be at the same level as market economies. The time needed for this equalization of productivity levels in the various countries depends on the dimension of the gap, the current growth rates and the future change in growth rates.

The present decline in productivity growth rates is of course not favorable for a process of equalization between productivity levels of different countries which have experienced such a decline. What is the reason for this phenomenon? It would be a rather formal and trivial explanation, if we took only the dependency of change in productivity growth from the level of productivity and from the level of growth rates. There must be a causal impact, working in the same direction in all developed countries. Such a universal factor might be the lack of basic innovations. The most important growth industries in the last thirty years were chemicals, electrical engineering, automobiless, plastics, petroleum products and aircraft. But now we have a negative change in productivity growth even in these industries which has not been compensated by new basic innovations. If the real explanation for the decline in productivity growth rates was the lack of basic innovations, one is forced to ask: What is the reason for this phenomenon?

There are two tendencies which have a great impact on efficiency. First, the increasing capital coefficient leads to a strong orientation towards improvement of given technological systems. Nobody is interested in essential changes if they are interlinked with big losses in capital funds.

Therefore, it is understandable that there is a strong tendency towards improvement policy (changes of lower order) in many firms.

On the other hand, the situation is different in various industries. The number of major innovations over the period from 1953 to 1973 in electrical equipment and communications is significantly higher than in traditional textiless or paper production. To go into more detail, the age of principal technical solutions in washing machines, refrigerators, textile machines, batteries, electrical tools, combustion engines, and transport machines is, on average, higher than 25 years. On the other hand, the age of principal technical solutions in radio components, electronic calculators and watches, is less than 10 years.

For a deeper explanation of the productivity dilemma we have obviously to study the long-term tendencies of economic mechanisms and in resource utilization.

*Organization for Economic Cooperation and Development.

**Council for Mutual Assistance, CMEA or Comecon

Productivity of capital stock OM

Definition

Output per unit of capital input or the ratio of the physical productive capacity (output) to the current real value of the stock of capital facilities and equipment. In the planned economies a similar indicator exists as a ratio between output and productive funds or productive fixed assets.

Profit margin OM

Definition

The percentage that net profit from operations is of net sales or capital invested.

Pseudo innovations OM

Definition

In reality, some innovations exist seemingly appropriate to meet the goals of the socio-economic system or subsystem, but having a mainly negative influence on it over a long time. Its primary or secondary consequences damage the efficiency of the system. These innovations are called Pseudo-innovations-PI. A large share of PI one can find in the consumer goods industry. In American supermarkets, where it is estimated that about 1500 new products appear each year, less than 20 percent survive more than one year on the shelves, the remainder having proved unsaleable, faddish, risky, or unprofitable, or made obsolete by competitors with new models.

Furthermore, one can state that positive technological changes with positive socio-economic potential can appear as innovations rendering negative effects. This can be demonstrated by the following scheme (Table 9).

So we can have the situation that a major technological change (potential BI) occurs only as an II or as a PI. This depends on the ability to use the innovation potential by changing many conditions and relations necessary for the efficiency of the new or renewed system. All these conditions change over time, so a potential BI may or may not become a real BI. For example, automation of the production process in a given non-automated industry is a basic innovation. In reality it may become an improvement innovation if it is not possible to change the traditional process. Such automation without process changes is not very efficient. Solar energy is a potential basic innovation, but in reality it may occur only as a pseudo innovation in the cases where solar heating systems are installed in existing building without changing other preconditions. Another problem is that an innovation could be determined and planned as an improvement innovation and later on we discover that it is really a basic innovation. The qualitative potential of an innovation is often not clearly realized and the same is true for its quantitative potential. In some cases a pseudo-innovation might be changed into an improvement innovation through the learning process, which was induced by the negative results.

Table 9. Changes of potential into real innovations of the three types.

Real Potential	Real BI	Real II	Real PI
Potential BI	Automation in connection with new processes	Automation without changing the process	Retrofit solar heating system for residential buildings
Potential II	-	Oxygen process in metallurgy	Higher speed and motive power of automobiles
Potential PI	-	-	Product changes without real effect for the consumer

Rate of return OM

Definition
The ratio of profits to capital or investments.

Rationalization OM

Definition
The use of scientific management and industrial organization in production. The tern gives the main attention to improvement innovations and therefore the rationalization approach dominates in the maturation and saturation stage of the innovation cycle.

Raw material OM

Definition

An extracted or semimanufactured natural material which has already attained a labor value and which has to be changed in the process of manufacturing into intermediate products and final goods.

Recycling SP

Definition

In its most narrow sense, recycling of materials means the rescue of materials from disposal and their subsequent reuse in essentially the same form. Thus, the recycling of paper means the collection of waste paper and the reprocessing of the recovered pulp into new paper; the recycling of glass bottless means the collection of used bottless and their reprocessing into new bottless. In practice, however, this narrow sense of the definition has been enlarged to include several additional meanings. One such meaning is reuse: stationery, for example, may be reused for additional writing, as in using the reverse for scratch paper, or may be used for another purpose unrelated to writing, as when incorporated into building materials like insulation and hardboard. Another meaning concerns conversion of a waste material from its existing form into another form which is then useful, as in converting wastepaper to cattle feed or compost. Still another meaning concerns the use of a material so as to consume its substance entirely, as in burning wastepaper for fuel. Strictly speaking, reuse, conversion, and consumption do not represent recycling, but all have popularly come to be included within the term. Thus, in the broadest sense, recycling is the creative management of a waste material so as to obtain the maximum additional value from it, in contrast with disposing of the material as solid waste at additional cost.

Cf. Materials Management.

Relative efficiency OM

See also:
Efficiency cycle

Definition

The natural trajectory of an industry is not only determined by the characteristics of the special innovation process, it is very much influenced by the environment of the innovation and the close interaction with other industries. In order to reflect this condition one can use the concept of relative efficiency which was developed due to the needs of a planned economy.

The efficiency indicators of a given production system cannot tell us if the system is using the allocated resources due to requirements and necessities, which are imposed by the economic system as a whole. These indicators should be compared at least with the efficiency indicators of the next highest system (for example, a sector of industry) or with the efficiency indicators of the whole industry.

Efficiency is the relation of output, O, and input, J, over time

$$e(t) = \frac{O(t)}{J(t)} \tag{1}$$

Efficiency of an innovating system or dynamic efficiency is

$$e_i(t) = \frac{O_i(t)}{J_i(t)} \tag{2}$$

Efficiency of the higher system is

$$e_s(t) = \frac{O_s(t)}{J_s(t)} \tag{3}$$

Relative efficiency of an innovating system is therefore

$$e^*(t) = \frac{e_i(t)}{e_s(t)} \tag{4}$$

On the other hand, efficiency of the higher system is

$$e_s(t) = \frac{\sum_{i=1}^{n} e_i(t) p_i}{\sum_{i=1}^{n} e_i(t)} \tag{5}$$

where

$e_1(t)$ = efficiency of prproduction system i, i = 1,2,...,n
p_i = prproduction share of the system i.

and

$$\sum_{i=1}^{n} p_i = 1 \tag{6}$$

Clearly, that the efficiency of the next higher system depends not only on the efficiency of the innovating systems i = 1,2,...,m, but also from the efficiency of the non-innovating systems m+1, x+2, ..., n and from the subsequent weights of those production systems. A high efficiency of the innovating system in comparison to former times may be in reality a low relative efficiency if the next highest system has improved its average efficiency considerably.

Renewal (Renovation) OM See also: Innovation

Definition

Change of a system by replacing, adding, reducing or modifying its elements.

Reproduction OM

Definition

Term of Marxist political economy, comprises production, distribution, circulation, consumption of goods and their permanent repetition, including all changes in social and physical preconditions of production. Simple reproduction is repetition of production at the same quantitative and qualitative level. Expanded reproduction is repetition of production at higher level with increasing inputs and outputs.

Research SP

Definition

Loosely, any gathering of information. More precisely, the gathering, ordering, and analysis of information on a systematic basis in accordance with predetermined criteria. Scientific Research is Research conducted in accordance with the scientific method. Research is concerned with the acquisition of knowledge while development is concerned with the systematic use of scientific useful materials, devices, systems, or methods, including the design and improvement of prototypes and processes.

Research, Applied SP

Definition

Systematic application of information, systematically acquired and validated. In particular, Applied Research is the practical application of such knowledge or understanding for the purpose of meeting a recognized need to develop a capability, employing the methods and data of Science (q.v.). It is distinguished from Development (q.v.) in that it does not extend to the design or construction of working processes or hardware.

Forms of Applied Researchs are:

Strategic Research:	Research undertaken to generate specific applied programs.
Product Research:	A subdivision of applied research whose objective is a new or improved product.
Process Research:	A subdivision of applied research whose objective is a new or improved process.
Operational Research:	The application of objective and quantitative criteria to decisionmaking previously talked by experience, intuition, or prejudice. Called "operations research" in the U.S.A. A subdivision of Applied Research.

Research, Basic SP

Definition

The systematic acquisition and validation of structured in formation or knowledge about the universe, employing for the purpose the methods and assumptions of Science (q.v.). In particular, Basic Research is directed toward a fuller knowledge or understanding of the subject under study, rather than toward the practical application of the knowledge or understanding. One view of this activity stresses that its motivation is curiosity about nature, leading the practitioner "to proceed along sophisticate disciplinary lines as delineated by peer judgment as to the frontier problem areas." Moreover, "open and free dissemination of the results of such inquiries is an international tradition of the [basic] scientific community."

Research, Exploratory SP

Definition

This category of investigation may be thought of as an intermediate stage between basic and applied research. Administratively, exploratory research is defined as "the early stages of research in areas not yet well enough defined or understood to merit full programmatic support."

Research, Fundamental SP

Definition

"The search for new knowledge in a broad but definite scientific field without reference to specific applications."

Typically it involves inquiries—frequently multidisciplinary— into such natural phenomena as elasiticity of polymers, catalysts, nuclear particle attraction, or the detonation process. Fundamental research is not—like so-called "pure" research— the pursuit of knowledge for its own sake. Fundamental research seeks knowledge which it is hoped will benefit someone someday. But the specific nature of its eventual application is not known at the time the research is performed.

In many cases, fundamental Research cannot be distinguished from Applied Research, (see Research, Applied) except by reference to the institution which conducts it.

Research, Interdisciplinary SP

Definition

Broadly, scientific research directed toward an objective or mission, involving practitioners of a number of relevant scientific disciplines. Various characteristics that distinguish Interdisciplinary Research from traditional single discipline research include: multiplicity of disciplines, use of tools or findings of several disciplines, mission orientation, and organizational setting. These are discussed as follows:

a. *Disciplinary mix:* Donald J. Cunningham defines interdisciplinary research as research done jointly by social scientists with other scientists: "research which is conducted by a mixture of investigators gathered both from the disciplines of the physical and social sciences." Another definition is: when investigation incorporates the finding tools and techniques of several disciplines, and particularly when it makes conceptual patterns and analyses pertaining to several branches of knowledge. The distinction between single discipline and interdisciplinary research is lost when research using the techniques of several disciplines becomes institutionalized as a new scientific specialty, such as biochemistry, astrophysics, urban affairs, or science policy. Indicators of institionalization of interdisciplinary research as a new scientific specialty include its publication of specialized journals, and the formation of scientific societies and teaching departments.

b. *Applied or problem- oriented:* Interdisciplinary research is generally applied and problem oriented—designed to provide a solution or alternative solutions to important and complex problems at the interface of society and technology.

c. *Organization setting:* A variety of organizational forms characterize the conduct of interdisciplinary research. These differ from the units in which single discipline research is generally conducted. Typical of these organizations unique to the conduct of interdisciplinary research are: a university, interdisciplinary research problem institute; a non-profit non- academic research institute, frequently located close to both universities and industrial centers; Federal laboratory; social scientists teaching or working in professional schools, such as law, medicine, engineering, etc.; and a university interdisciplinary department or an *ad hoc* public policy advisory group established to assess research needs or particular social problems cutting across disciplinary lines.

An attempt is sometimes made to reserve the use of the term "Interdisciplinary" to combinations of the physical sciences. (E.g., "Interdisciplinary Laboratories" sponsored by the National Science Foundation.) According to this view, the definition given above would apply to the term Multidisciplinary Research.

Research management SP

Definition

Research management includes the dynamic process of planning, organizing, leading, performing, administering, coordinating, and evaluating (1) scientific study; (2) experimentation; and, (3) for organizations in applied research, development, and production, the translation of that basic knowledge into new products, processes, and techniques.

"Different applications of the management process of planning, organizing, leading, doing, administering, coordinating and evaluating exist within many companies, according to the 'basicness' or 'purity' of the research and development. If the research is basic or 'pure' the management process is applied to the basic research least, with more freedom, relief from routine, less punching of time clocks, more confidence in his professional ability, more participation in matters in which he is concerned, more choice of projects or tasks by him—and in general, more democratic management and administration. The manager was found to apply fewer or less drastic controls because of the uncertainty involved, the relative lack of knowing where basic research is going (or how to do it), the greater degree of creativity involved, and the administrator's inability to tell the scientist what to do.

"The objective of basic research is more vague. The methods are less clearly defined, so that control cannot be as rigorously established. As research becomes applied to development and production, the objective can often be defined more clearly. In applied research, the goals of the new scientific knowledge are related more to the specific commercial objectives with respect to either products or processes. The greater the relation to the specific products or process that can be made, the more objective and exacting can be the management and administration—especially the control, organization, the planning, the goals, and purposes.

"The management of development, then, is even more objective in translating research findings or other general scientific knowledge into products or processes. Development can be managed, administered and controlled more definitely than basic or applied research. And thus, as the results of development go into production, definite products are produced and more definite planning and control can be managed."

Research, Mission-oriented (or, Mission-oriented science) SP

Definition

Loosely, any Applied Research (see Research, Applied) although it may also be used to cover certain basic research activities (or activities in "Fundamental Science") deemed pertinent. The term is particularly associated with scientific research to provide information or capabilities needed to support the development of a system or to support a program. In other words, "Mission-Oriented" signifies that the research is directed and constrained by the goals and ruless of some organizational entity and its mission.

According to one respondent, the term "fast-transit research" is sometimes used in Europe as synonymous with Mission Oriented Research, implying that the results of the research should be rapidly applicable to improve the efficiency of civil or military systems.

Research, Pure SP

Definition

Loosely, a term synonymous with Basic Research or Fundamental Research (see Research, Basic and Research Fundamental). There is a tendency to associate the term Pure Research with the exclusive intent to expand knowledge and understanding of the physical universe.

Resource(s) SP

Definition

In general, resources encompass all means or potential means toward ends or potential ends. They can include physical inputs, people (and their levels of training), information, institutional arrangements, available financial assets and credit, etc.

Resources may be tangible or intangible (e.g., beautiful scenery) and may be either valued or treated as free goods (e.g., air). Resources may also be exhaustible, renewable, or recycleable.

New definitions for mineral Resources have recently been adopted by the Bureau of Mines and the Geological Survey of the U.S. Department of the Interior. The present definitions are based upon two criteria: the extent of geologic knowledge about the resource and the economic feasibility of its recovery. These definitions include:

Resource: a concentration of naturally occurring solid, liquid, or gaseous materials in or on the earth's crust in such form that economic extraction of a commodity is currently or potentially feasible. Resources are of two types—*identified resources* and *undiscovered resources*.

1. *Identified resources:* specific bodies of mineral-bearing material whose location, quality, and quantity are known from geologic evidence supported by engineering measurements with respect to the demonstrated category. Identified resources are of two types—*reserves* and *identified subeconomic resources*.

    1.a. *Reserves:* that portion of the identified resource from which a usable mineral and energy commodity can be economically and legally extracted at the time of determination. The term "ore" is also used for reserves of some minerals.

    1.b. *Identified Subeconomic Resources:* known deposits not now xinerable economically.

The following definitions for measured, indicated, and inferred are applicable to both the Reserve and Identified-Subeconomic resource components:

Measured: material for which estimates of the quality and quantity have been computed, within a margin of error of less than 20 percent, from analyses and measurements from closely spaced and geologically well-known sample sites.

Indicated: material for which estimates of the quality and quantity have been computed partly from sample analyses and measurements and partly from reasonable geologic projections.

Demonstrated: a collective term for the sum of materials in both measured and indicated resources.

Inferred: material in unexplored but identified deposits for which estimates of the quality and size are based on geologic evidence and projection.

Identified- Subeconomic resources: known deposits not now minerable economically.

Paramarginal: the portion of subeconomic resources that (a) borders on being economically producible or (b) is not commercially available solely because of legal or political circumstances.

Submarginal: the portion of subeconomic resources which would require a substantially higher price (more than 1.5 times the price at the time of determination) or a major cost reducing advance in technology.

2. *Undiscovered Resources:* unspecified bodies of mineral-bearing material surmised to exist on the basis of broad geologic knowledge and theory. Undiscovered resources are of two types—*hypothetical resources and speculative resources.*

2.a. *Hypothetical Resources:* undiscovered materials that may reasonably be expected to exist in a known mining district under known geologic conditions. Exploration that confirms their existence and reveals quantity and quality will permit their reclassification as a reserve or identified sub-economic resources.

2.b. *Speculative Resources:* undiscovered materials that may occur either in known types of deposits in a favorable geologic setting where no discoveries have been made, or in as yet unknown types of deposits that remain to be recognized. Exploration that confirms their existence and reveals quantity and quality will permit their reclassification as reserves or identified subeconomic resources.

A respondent calls attention to the fact that the set of resource definitions promulgated by the U.S. Geological Survey differs from those used in England, France, and perhaps elsewhere.

Returns to scale OM

Definition

The relationship between equal proportional increases in all productive inputs and the proportional change in output using the same type of technology. Constant returns to scale assume a stable production function without any changes in parameters.

Risk analysis SP

Definition

The most important aspects in any commercial risk analysis involves three uncertainties: (a) market, (b) cost of development and production, and (c) technical difficulties. This kind of analysis is basically an effort or attempt to take specific account of these uncertainties rather than use "best estimates." In most cases, these uncertainties are in the form of subject probability distributions. The outputs of such studies are probability distributions of quantities such as discounted cash flow return on investment, net present value, and net income. Thus, risk analysis provides the executive with answers to questions such as the following: What is the chance of loss on a project and what is the likelihood of achieving a 15 percent return on investment?

A related concept is "engineering risk," which is the degree of probability that a given design of a system, incorporating a number of components, will be effective. The design problem is to find the optimum trade-off between the use of proved components (thus inviting the risk of early obsolesscence) and the use of wholly new and unproved components (thus inviting the risk of unreliability).

Risk/benefit analysis SP
(also, Benefit/risk analysis)

Definition

That portion of Cost/Benefit Analysis which pertains to the social costs of public health impacts of technology—such as deaths, disability, and discomfort. These elements of public risk are usually presented in mortality and morbidity statistics, but are most conveniently used in Risk/Benefit Analysis in the monetary terms of equivalent social costs.

A respondent notes: There has not always been an adequeately comprehensive vantage point from which to consider the issues: very often, the risks are borne from a separate group from those for whom the benefits may accrue (i.e., costs may be "external" to the underbaking). furthermore, the risks are not always apparent "*a priori.*"

Satisfying solution OM

Definition

Solution of a task or a problem which can be improved only by expenses, which exceed expected margins of benefit from improvements.

Scenario SP

Definition

The order or sequence of events, scenes, or situations. A methodology has been developed for analyzing alternative futures as "scenarios," by which a set of interacting forces (social, economic, political, technological, etc.) is assumed, characterized, and worked out in narrative form to a logical outcome. The purpose of the technique is to give a realistic, tangible illustration of the probable consequences of different policy options or goals. The term Scenario originated with the motion picture industry, to signify the story outline combined with descriptions of the kinds of pictures needed to help tell the story.

Science SP

Definition

This is a term for a broad area of human activity based on the unifying assumption of the universal relationship of effects to causes. It is aimed at discovering, characterizing, organizing, and explaining facts and relationships according to principless of systematic and logical thought. Characteristic of science is the method of developing and testing of hypotheses through empirical observation (inductive-deductive reasoning), the validation of findings through replication, the construction of orderly taxonomy of related information, and reliance on quantitative measurements employing accepted standards. Within the taxonomies of each scientific discipline, the scientific effort seeks to achieve progressively finer grain of detailed understanding; externally, each discipline of science seeks to establish relationships among classes of phenomena.

The term Science is loosely applied to encompass not only the activity itself but also the community of practitioners of science (Scientists), who are also governed by the rules and constraints (canons) of science. The term also embraces the products of science, in the form of discovered factual information, laws, concepts, inventions, and even novel artifacts relying on scientific discoveries for their inception.

As science encompasses both basic and applied activities, the practitioners of both categories of science are called Scientists. This combination of meanings should present no difficulty, however, as the shades of distinction between them in practice tend to be very fuzzy. On occasion, it is said, the workers in the same laboratory use the same equipment to perform the same operations at different times for different purposes, one of which is "basic research" and the other "applied research."

Science is sometimes described as a "value-free" activity, to suggest that it is normatively neutral in purpose and that the results of scientific discovery can be used for good or bad purposes. However, the canons of science are themselves normative values—for example, belief in the efficacy of rationality, respect for precise and careful procedure, and insistence on the free interchange of information.

"Nature" as it really is and "science," the characterization of nature through disciplined study, are not synonymous. The distinction is important in Science Policy (q.v.) analysis, particularly in regard to the allocation of resources to conduct scientific research. According to Dr. Charles S. Sheldon:

Science denotes "to know." By custom, human knowledge has been organized into disciplines, which are systemstized, interrelated sets of accepted laws, probabilities, and hypotheses. Classification of knowledge into disciplines is not the way nature works; it is man's invention to help him understand more systemstically the relationships within nature. Recognition of the imperfection of man's invention of the scientific disciplines has led to a proliferation among the disciplines, and to conjunctions among disciplines, to provide further categories of information produced by "interdisciplinary research." Actually, all investigation of the facts of nature must be interdisciplinary because no natural relationship can be observed by man within the constraints of a single, pure category of knowledge. The deeper any single scientific discipline penetrates into its own blocked out area of concern, the more it becomes involved with other disciplines. Nuclear physics looked to astronomy for demonstration of fusion; genetics consulted molecular chemistry for elucidation of genes; the study of plant propagation demands an understanding of electro-optics. Nature, in short, does not heed the disciplines man has invented.

One very real question is whether the large investment of public funds in basic disciplined scientific research, by being channeled into the artificial disciplines of science, is freezing in concrete as it were an obsolete and outworn structure of knowledge. Should we boldly attempt to restructure our disciplines? Should we give thought to the effect of public investment in possibly perpetuating an obsolete system of knowledge that may be obstructing our understanding, even while they make convenient the imparting of what we know?

Science Policy SP

Definition

(In this usage, Policy is the noun and Science the adjective.)

Science policy is generally conceived of as a deliberate and coherent basis for national decisions influencing the investment, institutional structure, creativity, and utilization of scientific research. Its scope encompasses the natural sciences (presumably including the life sciences), the social sciences, and technology.

In general, Science Policy can be derived from the coupling of these two definitions. However, by usage, the term Science Policy has come to embrace, at the level of national government, two different social functions: (1) the political process affecting the activity of organizations engaged in science or in the training of scientists, and (2) the political decisions that select particular scientific activities for public support by virtue of their perceived potential contributions toward social or political goals. Both deal with the political process as a form of influence or control on the conduct of scientific activities.

In the first place, science policy means policy for the development of technology, as well as policy for science as ordinarily understood. It is concerned with the allocation of resources for scientific research and technical development. It includes government encouragement of science and technology as the roots of strategy for industrial development and economic growth; but it also includes the use of science in connection with problems of the public sector. Because of the close association of basic research with higher education, this aspect of science policy is difficult to separate from overall educational policy and from technical manpower policy.

But science policy does not comprise only policy for science— that is, for the creation of an environment in which science can flourish and choices can be made among scientific and technological projects and fields; it also comprises science for policy affecting the ways in which scientific and technical considerations bear on important political decisions and policy choices in areas that are not themselves mainly scientific, such as foreign affairs or urban planning. Indeed, some observers have even questioned whether it makes sense to conceive of science policy as a distinct and separate area of policy. Nevertheless, science, including the social sciences, penetrates deeply into almost every aspect of the government function, as indicated by the growing percentage of technical specialists in the upper levels of the civil service. It requires consideration in its entirety as a set of means to other goals, having some coherence within itself across the functions that it serves.

With the increasing significance of science and technology for public interests and goals there has arisen a large number of institutes, associations, and university programs investigating and publishing on this theme. Also, with the large sums provided to the scientific enterprise by the "public patron," there has been increasing attention to various aspects of science and government with regard to the methods of support, areas of support, institutions for support, etc. Both the legislative and executive branches of Government have been searching for answers to the various issues involved, and recently State and local government attention has been drawn to the issues.

Science push hypothesis OM See also: Demand pull hypothesis)

Definition

Hypothesis assuming that scientific discoveries and technological opportunities are the prime source of innovations.

S-Curve SP

Definition

A specific, patterned rate of change in one parameter in relation to another, in which the change begins slowly, rises to a peak (maximum slope of the curve) and then flattens out. Shown graphically, the figure formed is roughly S-shaped.

This particular rate of change tends to be characteristic of natural processes in which development is at first slow, then reaches a maximum level of performance, and finally encounters a decisive constraint. Examples might be: rate of output of a mine, population growth in a limited geographic area, or marketing of a new product. In all three examples, the other parameter would be time.

Serendipity SP

Definition

According to Merriam-Webster, second edition, "The gift of finding valuable or agreeable things not sought for; a word coined by Walpole [Horace, Fourth Earl of Oxford] in allusion to a tale, *The Three Princes of Serendip*, who in their travels were always discovering, by chance or sagacity, things they did not seek."

The analogy with basic, pure, and fundamental research is obvious. However, there is no obvious reason why the analogy should not also be applicable as well to applied research in all its various forms.

Share of new products OM

Definition

Share of new products in industrial output is an statistical indicator, which is used fn market as well as in planned economies. Comparing it between countries, one has to bear in mind

1. Newness is sometimes defined on the corporation level (U.S.A.) and sometimes on the country level (USSR).
2. Definitions of newness vary among the countries. In GDR, for example, a new product is a good, which is produced for the first time in this country, based on R&D results, documents or licenses, which has a higher techno-economic level than other comparable products, which has essentially new or other properties in the function, in energy sources, materials, concept or capacity or which satisfies existing or new demand by new user characteristics.
3. The time-span for definition of a new product is in some countries three years (U.S.A.), in other one year (USSR).
4. Statistics on the share of new products in market economies are based on voluntary answers to questionnaires and in planned economies they are produced by an obligatory procedure within the official statistics.
5. Normally these statistics have a bias among various branches. Textile industry has sometimes a higher hsare of new products than the chemical industry or mechanical engineering. Newness in engineering is much more important for the growth of national economy than newness in textiles. To exclude this bias one can correct the share of new products in industries by using the coefficient of R&D intensity. (R&D expenditure per unit industrial output).

Share of new technology in productivity growth OM

Definition

An indicator, used in planned economies.

$$S_{NT} = \delta t \frac{p'_L}{E_1 \cdot t_1 \cdot k_1 (p'_L - k')}$$

S_{NT} share of New Technology in productivity growth

δt Sum of working hours saved by technological measures

P'_L Productivity Index of all employees

t_1 Number of working hour per full job worker and year in year 1

k' growth Index for the share of workers in all employees

E_1 Number of full job employees in year 1.

k_1 Share of workers in all employees in year 1.

The sum of working hours, saved by technological measures is planned and reported by the enterprises. Actually this indicator is counted on the department or shop level in the enterprise. Sometimes it does not take into account additional demand for working hours, created by the given technological measure in other departments.

Side effects (also, Secondary effects, Second-order consequences, Indirect effects) (For Effects, Impacts is sometimes used) SP

Definition

The purpose of all Technology (q.v.) is to improve the compatibility of man with his Environment (q.v.) in some explicit way. However, it has been noted that technological innovations invariably produce other effects, unintended and often undesirable. These may be inherent in the innovation or they may result from its misuse. They may be immediate or long range, decisively important or minor, discrete or incremental or perhaps synergistic. They are usually related in impact to the extent of use of the technology from which the impact derives (cf. Diffusion of Technology).

Conceptually, the term involves two elements, an "effect" and the modifier suggesting that the effect in question is unmotivated and derivative.

From the comments received on this term, the impression is received that there exists some idea of an ordered structure of secondary effects (second-order, third-order, etc.) with time as perhaps another parameter. One respondent questioned, for example, the "merging of [Second-Order Effects]x completely under Side Effects" and contended that the former "has a specific connotation involving cause-effect over time affecting increasingly abstract or complex levels of the culture" while Side Effects "can include specific and immediate effects, expected or not; usually, it just means they were unintended or deleterious." In the physical sciences, Second-Order Consequences conveys the idea of a chain of causality: thus, effect A produced by cause A becomes the cause of

effect B which becomes the cause of effect C. In this sense, effect B is a secondary effect, and effect C is a tertiary effect. Also included in this concept is the idea that effect A may occur at once, but that effect B will occur later on, and effect C still ater.

In the field of medicine and drugs, the term side Effects means simply an unintended effect. Unfortunately for simplicity, the side effect of a drug developed for the treatment of Parkinson's desease may be discovered to affect male sexual activity and perhaps be prescribed for this effect, or a birth control pill may be prescribed as a hormonal treatment to correct skin blemishes. Thus, side effects are not necessarily undesired and, once characterized, may be converted into intended effects.

These are perhaps useful distinctions, but it is not clear that they are universally adhered to in Science Policy usage.

Social interdependence of innovations OM See also: Socio-economic opportunity analysis (SOA)

Definition

Innovations are closely linked together in certain kinds of connections. The main connections are:

(a) The vertical connections from raw material to final product and to market. We can investigate the interdependence of innovations in this cycle, using the dates about material and energy flows or the bottlenecks in the substitution of labor force by modern technology. Analysis is possible by the following steps:
- principal scheme of the technological structure;
- material flow diagram;
- energy flow diagram;
- capital equipment per man or degree of automation in all elements of the technological structure;
- range of potential innovations, able to overcome leaks and bottlenecks of the systems;
- evaluation of these potential innovations;
- estimation of lacking innovations;
- innovations of great importance able to create new imbalances;
- recommendations for technological policy in the whole system.

(b) The horizontal connections in and among complexes of needs. There exists a lot of studies about complexes of needs, but they are not linked with the innovation problem. It is necessary to provide such types of innovation analysis because of the high influence of the demand factor.

(c) The substitutive connections within and among complexes of resources.

Societal learning OM

Definition

If one looks at societal development from the standpoint of human forces, we can distinguish between societal learning and societal creativity push. Societal learning is a very complex phenomenon, which is very generally defined as adaptation of social man to a changing environment. Societal learning consists of a dynamic and a static element. The static element is called by the authors of "The Human Hap" (The Club of Rome, 1979) "maintenance learning' or acquisition of fixed outlooks, methods, and rules for dealing with known and recurring situations. The dynamic element is also called by these authors "innovative learning," a type of learning that can bring change, renewal, restructuring, and problem reformulation. This is a very useful distinction within the learning process. But of course one cannot reduce the "human gap" to a "learning gap" and also not extend the learning term on all human activities. Human activity is closely connected with learning, but at the same time it has a creative component leading o breakthroughs and to the beginning of entirely new learning curves, not comparable with the former.

Societal learning cannot be reduced to a certain sum of individual learning. Dynamic societal learning is connected with improvement of material capacities, of social relationships, institutions and values as well as the improvement of individual learning. Another side of human activity is creative change in productive forces, in social relations and in institutions and values, connected with an upswing in societal creativity. A societal creativity push cannot be reduced to a small number of Nobel Prize winners or representatives from basic research. It can be a very complex phenomenon in science, in arts or in technological progress. The elitist approach to creativity gives main attention to leading key people in creative change, but this approach does not take into account the social background of the individual forerunners, as well as the social backing and implementation of their ideas which is also a process which needs the creative support of many people.

Societal learning is a very powerful means of adjusting societies to evolution of needs and natural conditions, but it is not enough to overcome global resource crises and other global problems. For this a real societal creativity push is necessary connected with overcoming social barriers which inhibit the solution of global problems.

Paying most attention to the creativity push this does not mean that one can forget about the interdependence of creativity and learning. There is no creativity without learning and conversely learning is influenced in many ways by creative pushes. In various societies the relationship between learning and creativity was quite different. The birth and upswing of a society brought an important creativity push, mainly on the side of the leading forces, further progress was supported by less creativity, and more by dynamic learning; and a lack of creativity and dynamic learning was the environment for stagnation and decline for a given social structure.

Socio-economic opportunity analysis—SOA OM

Definition

We can differ between three systems of considering the innovation process:

Innovation
Organization (corporation, firm)
Society

There exist two approaches for the linkage between technological change and societal needs. One can start from single technological changes and look at the social consequences and implications or at the needed measures on the governmental level to ensure its efficiency. This is, for example, the main aim of technology assessment. Or one can go out from social needs and goals from existing and forthcoming leaks or bottlenecks in resource processing systems and then look at the given field of technological possibilities. We call this second approach socio-economic opportunity analysis—SOA.

Software SP

Definition

Originally, dry goods—cloth and related materials. With the advent of the digital computer, the term has taken on a special meaning. The computer itself, its permanent and temporary memory banks, its consoles, readers, and linkages, are called "Hardware" (q.v.). To distinguish the programs telling the computer what to do, and the "language" to be used in communicating with the computer, these elements are referred to as "Software."

Spin-off SP

Definition

A Shorthand term for a sequence in which technology developed expressly for major (mainly acrospace) governmental purposes is then applied elsewhere with economic benefit. It is identical with the "horizontal" form of Technology Transfer (q.v.).

The encouragement of Spin-Off often requires some additional development and almost always requires a repackaging of information.

State of the art SP

Definition

A general term of applied science, engineering, and systems engineering. It refers to the level of useful development in some category of technology; it carries the implication that if design should call for performance requirements or a level of sophistication that exceeds the present stage of development it will invite a significantly increased level of engineering risk. Generally speaking, applied research has the purpose of advancing the State of the Art in the subject to which it is addressed, to reduce the engineering risk that might otherwise be involved.

Steady state SP

Definition

Although it is axiomatic that all systems in the universe tend to run down, nevertheless this process can sometimes be arrested for limited periods of time. In the organization of systems, it is the function of Feedback (q.v.) to achieve this. Such a period of arrestment, although never absolute or infinitely extended, is termed a Steady State. It is an approximation, a general balance, with no evident radical (exponential) or persistent deviation.

If all systems and all components of systems are in a dynamic state, then they are all in a state of continuous change. Under such a concept, the term "Steady State," as applied to the total system, suggests that (in the words of one respondent) "the rates and types of changes are such that the overall macro pattern remains undisturbed against the background flux of micro-changes." (Compare Homeostasis, for a condition in which macro and micro are reversed from this condition.)

Strategy SP

Definition

Initially the term Strategy was limited to military usage, with reference to the broad over-all conduct and planning of a war. One expansion in application of the adjective form was in the distinction between "Strategic" and "Tactical" weaponry with megaton weapons considered in the former category. The analogy of comprehensive versus situational military planning has been extended to nonmilitary subject areas, in which long time spans, large undertakings, and comprehensive systems are viewed as "strategic," while lesser items are "tactical."

Substitution SP See also: Functional substitution

Definition

Substitution (noun) is the action of replacing one material, part, design, or other item with another. The item thus introduced is called a Substitute. (The word Substitute is also used as an adjective, as in Substitute Material.) A material capable of being replaced by another is termed, "Substitutable" or sometimes "Substitutionable." Thus, aluminum may be used instead of copper, or synthetic rubber in place of natural (hevea) rubber.

In some usages the term Substitute may carry the implication of inferiority. (Hence the advertising slogan, "accept no substitutes.") In military parlance, when materials conservation is required, one approach is that of Substitution of a more abundant material in place of a less abundant material. However, the term Alternate Material is used in preference to the possibly pejorative Substitute Material.

Substitution, Functional SP

Definition

Functional Substitution is a special form of Substitution in which the replacement involves a change in function rather than in composition per se. For example, in the shaping of machine tool cutting tips, diamond wheels are usually used. Another approach might involve ultrasonic shaping in a boron carbide slurry with soft copper rubbing the carbide against the tool to be sharpened. A gas turbine (jet or turbojet) engine would be a functional substitute for a reciprocating engine in an aircraft.

Synergistic effects OM

Definition

Potential coming from combination of various forces and exceeding the simple sum of their single effects. Synergistic effects have the following properties:

1. A critical mass of causing forces is necessary
2. All forces interact closely
3. An economy of the commonly used resources is ensured
4. Multistability of elements or their partial or temporary independence is given.

Task OM See also: Problem)

Definition

Unsolved question or piece of work which has to be finished within a certain time. Tasks represent a gap between goals and the present state, which can be closed by using well-known operators.

Technical revolutions OM

Definition

In the last 250 years, mankind passed through four main technical revolutions, which had an important influence on industrial activity.

1. Textile technology
2. Railroad
3. Electro-technique and motor cars
4. Chemicals, Aircraft, Space, and Electronics

These revolutions were principal qualitative and quantitative changes in labor functions, in resources utilization and in the structure of needs. All four revolutions had three main properties, despite of their different technical character

1. Each of them was *caused by a bottleneck in the production system.* For example, railroadization became necessary because of the enrmous transportation demand for coal and cotton, which was created by the industrial revolution.
2. Each of them sprang up in one part of the production system and *passed them through a chain or a network* influencing step by step the whole production system and later on consumption patterns and life styles. For example, the spinning machine lead to the mechanization of weaving and later on to the improvement of white washing, printing and dying. The steam engine became the appropriate power source; and for such a developed machinery it was necessary to *produce machines by machines.* Increasing iron demand lead to increasing coal demand and so forth.
3. Each of the four technical revolutions lead to an important change in *labor functions.*

The question is, what will be the content of the next technical revolution in the future. Many experts connect it with microelectronics and telecommunications, while others mention the growth chances of bioindustry. There is no doubt that the next technical revolution will be again a societal complex of changes, affecting the role and structure of labor functions and helping to reduce societal bottlenecks.

Technique SP

Definition

Wilkinson, in his translator's note to Ellul's *La Technique, describes the scope of the title as the "organized ensemble of all* individual techniques which have been used to secure any end whatsoever." Lasswell is quoted in this same source as defining [Technique] as "the ensemble of practices by which one uses available resources to achieve values." According to Merton's interpretation of Ellul, the French writer sees technique as "any complex of standardized means for attaining a predetermined result." It seems impossible to distinguish Technique form Technology (q.v.).

Technological (or Technology) lag SP

Definition

Generally, a technological lag can be said to exist in a firm, industry, or national industrial system when a Technology Gap (q.v.) can be perceived between levels of technological potential or achievement. Evidences of an assertedly developing lag in U.S. technology vis-a-vis that of Western Europe and Japan are the decline in U.S. industrial productivity growth, both of labor and capital, and a deterioration in the U.S. foreign trade position.

Michael Boretsky, an economist with the U.S. Department of Commerce, has identified three causes of what he considers the recent loss of U.S. technological advantage: a lower growth in investment in new industrial plant and equipment in the United States than in other industrialized countries since the early 1950's; an underinvestment in economically relevant research and development relative to other industrialized countries since the beginning of the 1960's; and a worldwide and practically one-sided Diffusion (q.v.) of existing U.S. advanced technology in the form of patent rights and licenses together with appropriate instructions, blueprints, and other technical assistance since the end of World War II and particularly since the end of the 1950's.

In the opinion of the editor of this Glossary, the direction of flow of technology from one country to another is of particular importance insofar as it tends to indicate the relative aggressiveness of the two countries in seeking to acquire (and subsequently to perfect) useful technology from abroad.

Technological obsolescence (also, Technology obsolescence) SP

Definition

A reduction in absolute or relative Cost/Effectiveness (q.v.) of a technological system, product, component, or input, caused by a change in the external circumstances surrounding it. (Historically, technological obsolescence has been associated most closely with economic criteria, but the term "Effectiveness" (q.v.), used in the definition, reflects here a broader scope of criteria.)

Obsolescence usually implies the appearance of a superseding item or operation economically or functionally superior. Various other forms of

obsolescence are also possible; for example, a finding that a given technological artifact, process, or system has social or medical disfunction, like the drugs heroin or thalidomide, or a recognition that environmental consequences may be commandingly adverse, as with some of the organic synthetic pesticides.

It is noteworthy that Assessment ox Technological Obsolescence has nto attracted attention as an appropriate subject for policy study to the extent that Technology Assessment has done, yet the Side Effects of such obsolescence can be serious. Examples are the economic decline of Appalachia as a consequence of the technological obsolescence of coal as principal fuel, the loss of agricultural productivity that could result from restrictive regulation of posticides, and the disruptive effect on industry of premature or arbitrary regulation against air and water pollution.

A respondent comments: I would include also the impact on manpower when made obsolete by the warning of skills and the overtaking by new technical growth. In the past, the impact of automation has been of concern in this regard; more recently, the need for conversion and retraining has been of public interest in connection with scientific and engineering unemployment.

Technology SP

Definition

Compare Technique.

The term "Technology" in its earliest usage signified mechanical tools and implied machinery of various kinds. However, it has come to signify tools and their development and use in the broadest possible sense. It encompasses any systemstic employment by man of the cause-and-effect relationship (cf. Science) or empirical (cut-and-try) methods to achieve some desired purpose. It is the opinion of the author of the Glossary that the purpose of all technology can be generalized as an attempt to modify in some intended and desired way the relationship or compatibility of man and his environment.

Accordingly, technology encompasses all basic and applied research, all Edisonian inquiry, all manufacture and use of products, all knowledge rationally applied to agriculture, biomedicine, applications of sociology and other behavioral sciences, and any other rational human actions toward intended results.

It is hard to distinguish the boundary lines between basic and applied science and technology. The point is that both basic and applied science are a part of technology. Thus, basic science is an information function; and applied science is an information function with a useful purposes in mind- while technology is the development and social use of information. A great deal of technological innovation, over the years, came into being without the aid of science; and conversely, a great deal of the information uncovered by science has not found useful application but is still judged as potentially useful, or as the basis for useful understanding. Also, to the extent that basic science involves measurement or observation employing tools and devices it is dependent on previous technological innovation. Many great scientific advances resulted from this sequence, as for example from the microscope, telescope, spectroscope, etc.

A distinction can be drawn between technology as a process and as a product. Technology-as-process is those patterns of action by which man transforms knowledge of his environment into an instrument of control over that

environment for the purpose of meeting human needs. Technology-as-product is understood as comprising the range of tools, machines, procedures, etc., produced as results of technological action.

One industrial definition of Technology calls it "the knowledge necessary for the productive functioning of an enterprise." Accordingly, the term in this usage includes process, engineering, production, and marketing know-how.

An interesting trend in the meaning of Technology is revealed by a comparison of the definitions in the Merriam-Webster 2nd and 3rd editions. In the 2nd edition, the word is defined:

1. Industrial science; the science or systemstic knowledge of the industrial arts, esp. of the more important manufacturers, as spinning, weaving, metallurgy, etc.
2. Terminology used in arts, sciences, or the like.
3. Any practical art utilizing scientific knowledge, as horticulture or medicine; applied science contrasted with pure science.
4. *Anthropol.* Ethnotechnics.

Contrast this definition with that in the Merriam-Webster 3rd edition, which is as follows:

1. The terminology of a particular subject: technical language
2. a: the science of the application of knowledge to practical purposes: applied science (the great American achievement has been...less in science itself than in --- and engineering—Max Lerner) b (1): the application of scientific knowledge to practical purposes in a particular field (studies are also made of polymeric materials to dental ——Report: Nat'l Bureau of Standards) (2): a technical method of achieving a practical purpose (a --- for extracting petroleum from shale) 3: the totality of the means employed by a people to provide itself with the objects of material culture.

Technology as application of scientific knowledge to the production of goods is mainly used in Western countries and not so much in planned economies. In Russian, Technology means process. For the term Technology, stand the words Science and Technique in planned economies. Very often the term Cycle of Science, Technique and "Production" is used.

Technology assessment SP

Definition

A generalized process for the generation of reliable, comprehensive information about the chain of technical, social, economic, environmental, and political consequences of the substantial use of a technology, to enable its effective social management by decisionmakers.

Initially advanced as an instrument to provide advice to political decisionmakers, the concept has been increasingly accepted as a policy service within corporate management of private businesses.

As originally conceived, in a bill introduced by Congressman Emilio Q. Daddario, in 1967, the process was described as—

...identifying the potentials of applied research and technology and promoting

> ways and means to accomplish their transfer into practical use, and identifying the undesirable by-products and side-effects of such applied research and technology in advance of their crystallization and informing the public of their potential in order that appropriate steps may be taken to eliminate or minimize them.

In the study, *Technical Information for Congress*, Technology Assessment was defined in the following passage:

> Before, during, and after the building of a technological system, it is necessary to identify and study the consequences of the total technological society, including the minimizing of consequences which are unintended, unanticipated, and unwanted. Assessment includes forecasting and prediction, retroactive evaluation, and current monitoring and analysis. Measurements involve non-economic, subjective values as well as direct, tangible quantifications. Above all, assessment requires that catastrophic consequences of each proposed new technology be foreseen and avoided before the new technology becomes entrenched in the socioeconomic complex of human organization. Above all, irreversibly adverse consequences need to be foreseen and avoided.

A study of Technology Assessment by the National Academy of Sciences accepted the Daddario definition (above) but devoted many pages to an intensive examination of its implications, in terms both of the process required and the institutional mechanisms for its implementation.

A study of the subject by the National Academy of Engineering distinguished two different kinds of Technology Assessment: problem-initiated assessments. These were:

1. Assessments directed to the solution of identified problems of society which are usually amenable to systems analysis for their solution; and
2. Assessment to enable society to cope with the unfolding chain of cause-and-effect relationships stemming from a new technology.

It has been suggested that to these should be added two other kinds of Technology Assessment. These are:

1. Policy-oriented studies; and
2. Studies undertaken (usually in an academic environment) for the purpose of developing assessment methodology, rather than as an input to decision-making.

The author of this glossary is not persuaded of the validity of these last two additions, however, because the first ought to be the product of all assessments, and the second yields no substantive assessment at all.

In the Report of the President's National Goals staff, a chapter was devoted to the subject of Technology Assessment. In it was presented a further definition, as follows:

> A systemstic planning of forecasting process that delineates options and costs, encompassing economic, environmental, and social considerations (both external and internal) and with special focus on technology-related "bad," as well as "good," effects.

Out of these definitions emerges a concept of a purposeful and iterative search for significant secondary consequences and side effects (the "total impact") of a technology; identifying affected parties; evaluating the social, environmental, and cultural impacts; considering feasible technological alternatives; and revealing constructive opportunities; with the intent of managing technology more effectively to achieve societal goals. The process is a neutral and objective structuring of information about tradeoffs, priorities, options, and alternatives, to promote effectiveness in management decisions in the control

and use of technology—not only in the present but for an indeterminate future.

It is essential that the process not be confused with the decision process, but rather that it be recognized as an input to it. This poix was elaborated in *Technical Information for Congress* in the passage—

> In the management of a political issue with substantial scientific or technological content, the political issue is always larger in scope than the scientific question within it. In principle, the scientific question needs to be dealt with first. It is important that the scientific question or issue be carefully framed so that the answer to it provides a useful and significant piece of evidence for guidance in the consideration of the broader political issue.

Moreover,

> ...Every technical decision that provides the underpinning for a major political decision should receive adequate professional consideration, and...the outcome and its justification need to be expressed in terms meaningful to those responsible for the political decision.

Accordingly, it is suggested that the process of Technology Assessment is one of three elements in the management of technology by society. The first is the process of science and technology, producing innovations as solutions to social problems and needs. There may be economically attractive, or may require public funding; either way, they may become candidate claimants for political decisionmaking. The second element is the assessment of these technologies as solutions. The third element is the political process by which the social benefits and costs are finally judged and appropriate public action decided upon. Technology Assessment, then, is the technological information input to the political decision process.

Technology forecasting SP

Definition

(Also called "Technological Forecasting," although this usage is suspect). In general, Technology Forecasting signifies the estimating of probable availability or use of a technological innovation at some specified future time. According to Jantsch:

> ***Technological forecasting*** is the probabilistic assessment, on a relatively high confidence level, of future technology transfer. ***Exploratory technological forecastingx*** starts from today's assured basis of knowledge and is oriented towards the future, while ***formative technological forecasting*** first assesses future goals, needs, desires, missions, etc. and works backward to the present. (Gabor) The subject of both types is a dynamic picture of a technology transfer process. Technological forecasting may be aided by anticipation and may "harden" to prediction.

Technology gap SP

Definition

This is a shorthand expression referring to a perceived inequality in national level of technological potential or achievement, as evidenced by national differences in such characteristics as percentage of gross national product allocated to scientific research, rate of investment in new capital formation, numbers of new products appearing on the national market, educational level attained by the population, character of exports and imports as "high" or "low" technology, etc. Various publications have offered strategies for closing the "gap" and others have addressed the question as to whether or not such a gap in fact existed or could be precisely characterized or measured. *The American Challenge*, by J.J. Servan-Schreiber, erects an elaborate thesis around the proposition that there is a gap, favoring the United States, and that it can be closed by positive and concerted action of European countries. The studies by Michael Boretsky, an economist with the U.S. Department of Commerce, advance the thesis that there has been a gap—favoring the United States—and that it is attributable to past U.S. efforts supportive of research and development leading to the simulating of innovations in "high technology" (q.v.), but that such an asserted superiority is short-lived and waning.

Technolog, High SP

Definition

A loosely defined and imprecise term that appears to carry the implication that some kinds of technological innovation involve a higher content of scientific input than others. While it is true that some technologies have been developed empirically, nevertheless it is at least plausible that all technological innovations are amenable to improvement by the systemstic application of Science (q.v.). Perhaps the nearest approach to precision of a definition of High Technology would be: hardware developments relying extensively or chiefly on recent discoveries of the physical sciences (q.v.) for their operational principle.

Examples of developments usually cited as belonging in the category of High Technology are aerospace, electronic, computer, and nuclear systems. Low Technology, by contrast, would encompass such industries as textiles, glass-blowing, iron casting, and wood manufacturing. However, in even the most traditional classes of industries it is possible to find evidence of intensive application of technology. In textile weaving, for example, the multi-dimensional weaving of unconventional fibers is a recent development. Even in agriculture a very large scientific and technological component is evident.

Technology, Intermediate SP

Definition

Intermediate Technology is a term introduced and popularized by E.F. Schumacher to represent a level of technology partway between the primitive, indigenous technology of underdeveloped countries and the highly, sophisticated technology of industrially-developed countries. As viewed by Schumacher, Intermediate Technology would help provide what the poor people of developing countries most require, for example, building materials, clothing, household goods, agricultural implements, water and crop storage facilities, and the means for processing the first stages of their agricultural products.

"Intermediate technology does not imply simply a 'going back' in history to methods now outdated....The development of an intermediate technology...means a genuine forward movement into new territory, where the enormous cost and complications of production methods for the sake of labor saving and job climination is avoided and technology is made appropriate for labor-surplus societies." Cf. Appropriate Technology.

Technology, Public SP

Definition

An aspect of Technology Transfer (q.v.) mainly concerned with the transfer of technology for solving some of the major problems of society, particularly urban living, including solid waste management; municipal services, like police, fire, and health; traffic systems; housing and construction; municipal management and information systems; and pollution control.

Technology transfer SP

Definition

This complex and incompletely understood process involves Communication (q.v.) in which the message contains technological elements. The transfer can be vertical (i.e., successive transmissions of ideas cumulatively toward a complete design or process) or horizontal (from one user to another). Either kind of transfer can be intranational or international.

An excellent example of the various stages of this process is presented by the development and deployment of the Pilkington float glass process. This Innovation (q.v.) was developed in England, based on an American patent (Invention, q.v.). The process was first perfected and put to work in England and then licensed to other producers in a number of foreign countries. It is not unlikely that some of these licenses will in the due course introduce further improvements on the process, and that these in turn will be transferred back to the originating company.

An industrial view of this process relates it to such mechanisms as: licenses, direct investment, joint ventures, technical assistance and management contracts, consulting and turn-key contracts. The choice of the method of

transfer is dependent upon the type of technology and industry, governmental regulatory restraints, the size of the market, the sophistication of the user of the technology, and the costs and benefits to the supplier and user.

A subject of current interest (late 1978) is the transfer of technology from developed to developing countries, and in particular the role of multinational corporations in such transfer.

Technology utilization SP

Definition

Technology Utilization is a process or mechanism whereby knowledge is put into action. It may be viewed as a means by which existing research knowledge is adapted and applied operationally to useful processes, products, or programs which meet actual or potential public or private needs. The term implies the transfer of existing or new knowledge from its developers to users of research such as policy makers and managers. According to Gruber and Marquis, Technology Utilization emphasizes the ability or willingness of an entrepreneur (public or private) (public or private) to apply available technology to an ultimate use or creation of a marketable end product. It is roughly synonymous with Innovation (q.v.) in its emphasis on commercial application.

Threshold SP

Definition

The lowest level or concentration at which a particular phenomenon affects a system; also commonly, but erroneously, the lowest level or concentration at which a particular phenomenon can be detected. For example, the levels at which a human hears sound or feels pain are the threshold levels of sound and pain, respectively; the threshold of a change in a physical substanc may be measured, for example, in terms of the boiling or freezing temperatures of the substance or by related changes in the Ambience (q.v.).

The determinations of threshold levels may often be constrained by the limitations of detection devices. For example, some substances or radiation in any amounts may cause Toxicity (q.v.), particularly chronic poisoning. The apparent threshold of toxicity in such cases would be the level of detection registered by detection devices, rather than the actual, and perhaps much lower, threshold of toxicity caused by the first absorption of toxic substances or radiation by living tissues.

The concept of threshold presents problems in the regulation of some kinds of environmental insults. The threshold for acute toxicity is higher than the threshold for chronic toxicity. In the case of radiation, there are two conflicting concepts of threshold: one is that all radiation exposure, no matter how small, is injurious to exposed human tissue so that there is *no* threshold; and the other is that a threshold exists which is determined by the rate at which the human organism is able to repair radiation damage.

Time needed for equalization of productivity level in two countries OM

Definition

Given is

- the productivity level, yt, of the countries A and B at the time point, t=1;
- the average productivity growth rate, λm, for the time period t=1,2,...,m in both countries; and
- the expected future productivity growth rate λr for the time period t=m, m+1, ..., m+r.

Then we can assume

$$Y^A = Y_1^A(1 + \lambda_m^A)^{m-1}(1 + \lambda_r^A)^r \quad (a)$$

$$Y^B = Y_{1x}^B(1 + \lambda_m^B)^{m-1}(1 + \lambda_r^{B)^r} \quad (2)$$

The growth rate is

$$\lambda_m = \sqrt[m-1]{\frac{Y_m}{Y_1}} - 1$$

From (1) = (2) we get

$$r = \frac{\ln\frac{Y_1^A}{Y_1^B} + (m-1)\ln\frac{1+\lambda_m^A}{1+\lambda_m^B}}{\ln\frac{1+\lambda_r^B}{1+\lambda_r^A}} \quad (3)$$

This equation has a real sense for our problem, if

$$Y_1^A > Y_1^B \quad (4)$$

$$\lambda_r^B > \lambda_r^A \quad (5)$$

$$\delta\lambda = \lambda_r - \lambda_m, \text{and} \quad (6)$$

$$\delta\lambda^B > \delta\lambda^A \quad (7)$$

$$r = \frac{\ln\frac{Y_1^A}{Y_1^B} + (m-1)\ln\frac{1+\lambda_m^A}{1+\lambda_m^B}}{\ln\frac{1+\lambda_m^B+\delta\lambda^B}{1+\lambda_m^A+\delta\lambda^A}} \quad (8)$$

Let us substitute

$$\ln \frac{Y_1^A}{Y_1^B} = C \tag{9}$$

$$1+\lambda_m = i\lambda m \tag{10}$$

We can write now equation (7)

$$r = \frac{C+(m-1)\ln \frac{i_m^A}{i_m^B}}{\ln \frac{i_m^B+\delta\lambda^B}{i_m^A+\delta\lambda^A}} \tag{11}$$

In practical cases C, m, i_m^A, i_m^B, are given. For $\delta\lambda^B$ and $\delta\lambda^A$ we can assume a first estimation over the period r^*. By calculating (11) we get a first approximation r_1. Then we must compare r_1 and r^*.

a. $r_1 > r^*$
b. $r_1 = R^*$
c. $r_{1x} < r^*$

In the cases b. and c., there is obviously no problem. But in the case a., we should decide, if there is any reason for improving the firstly assumed $\delta\lambda$. And so we get a second approximation of r.

Iteration continues until

$$r_n - r_{n-1} \leq p$$

For p we assume

in short-term forecast (1-5 years)	p = 1
in middle-term forecasts (6-10 years)	p = 2
in long-term forecasts (11-20 years)	p = 5
in very long-term forecasts (over 20 years)	p = 10

Tools for planning OM

Definition

In a planned economy in the planning process the following methodological elements are used

Analyses
Forecasting
Strategies
Balancing
Norms and Normatives
Optimizations
Directions

Trade-off (noun, berb) SP

Definition

Foregoing some portion of one benefit in order to achieve some increase portion of another benefit; (or) foregoing some portion of a benefit in order to achieve a reduction in some portion of a cost; (or) accepting an increased portion of one cost in order to achfeve a decrease in the portion of another cost. Other more complicated permutations of this concept can be suggested. The term is in wide usage.

Yield OM

Definition

The percentage that is derived from dividing the annual return from any investment by the amount of the investment.

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