

GLOBAL PRODUCT AND LOCAL MARKETS — CRITICALITY OF INFORMATION INTEGRITY FOR COMPETITIVE ADVANTAGE

(A Research Direction)

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INDEX

Abstract

1. New Localized Internationalism of Market Place – A Designer Dilemma
 2. Global Business Enterprise: Open System view
 - 2.1 Reality of Existence of Horizontal Management Structure
 - 2.2 Information as function of Recipient
 - 2.3 Global Product in Local Markets – Requirement of Informational and Physical Work Systems
 3. Multinational Growth – An Informational View
 - 3.1 Principle of Internationalism
 - 3.2 Early Statement of Internationalization of Markets
 - 3.3 Early Statement of Criticality of Information Integrity for Competitive Advantage
 - 3.4 Organization for Structured and Periodic Information Processing for Distributed Decision Making – The Basis for Global Business Enterprise
 - 3.5 Global Business Model: Enterprise seeking “Standard” Product in High Volume
 4. Global Business process *IS* View for Product Customization – Individual Information Origination and Processing Situation
 - 4.1 Reality of Local Markets
 - 4.2 Multistage Decision Process
 5. Reorganizing System’s Definition
 6. Qualitative Statement of Criticality of Information Integrity
 - 6.1 Global Business Process *IS* Error Implications of 5“C”
 - 6.1.1 Complexity
 - 6.1.2 Change
 - 6.1.3 Conversion, Communication and Corruption
 - 6.2 Business Process *IS* Errors are not Business Errors but rather Information Errors in Business Setting
 - 6.3 Business Process *IS* View: Continuous Individual Information Origination and Processing Situation in the presence of Uncertainty
 - 6.4 Criticality of Information Integrity for Competitive Advantage
 7. Organization for Continuous Individual Information Origination and Processing Situation under Uncertainty – The Design Basis for Global Product in Local Market
 8. Research Direction
- References

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Abstract: With the advent of steam power, successes in production automation sharply increased the volume and speed of energy conversion and material processing. In the manner of a closed system view of global enterprises and their systems and under the assumption of static environment, this precipitated various structured and periodic information processing control responses for “standard” product in high volume business models. With innovations in information technology, the volume and speed of information processing and decision-making undergoing sharp increases, business enterprises for their competitive survival are looking for bigger business opportunities through customized products. In the manner of open system view of global enterprise, the business opportunity thus is in flexible (unstructured and a periodic) informational automation that has to “smartly” manage global informational requirements of a product in a local context. However, ever-present system environmental factors of 5“C”s make the open system view of organization and means of control in the form of information processing and programmed decisions infested with informational errors leading to loss of Information Integrity. Even if information technology innovations had been more gradual, due to 5“C”s, the ultimate result would have been same.

1. NEW LOCALIZED INTERNATIONALISM OF MARKET PLACE – A DESIGNER DILEMMA

When companies advertise their products, they reasonably assume that their sales will increase, or, at the least, not decrease. But modern global market situations are complex ones. A London based news item “Cadbury apologizes for Kashmir ad” in Times of India, New Delhi dated Thursday August 22 2002 read, “In a quickly cobbled statement on Tuesday, Cadbury Schweppes said, “From time to time local management make mistakes. This was clearly one and we trust that Cadbury India’s apology, which was made in good faith, will be accepted by those offended by the advertisement”.

The advertisement in question, published to coincide with the country’s Independence Day, featured a map of India highlighting Jammu and Kashmir with the words ‘Too good to share’ printed on it.” The punch line, ‘Too good to share’, was meant as a directive (information) on the chocolate as well as the disputed region. But it incurred the wrath of the local Indian leaders who criticized the ad for “trivializing the issue and lack(ing) basic sensitivity”. Further, the business analysts say the company, which has what insiders describe as a “reasonably successful, smaller wholly-owned subsidiary in Pakistan,” must be painfully aware of the negative impact its Kashmir ad could have on the Pakistani market. Thus because punch line (information) processed turned out to be function *also* of the recipient (in this case local market), and not *alone* of the ad designer (source – here Cadbury India) and of the medium of communication (process) as was assumed, for *that* (local) market the ad resulted in a real overall

possibility of undesired, negative effect on sales.

The news item quoted sources saying Kashmir being in the headlines with worldwide connotations there should not be any advertising connected with it. But the Western media is seeing this dilemma of designing the Kashmir ad as a test case for the challenge of the new localized internationalism of the market place, which forces multinational companies to provide a local focus for their local wares.

2. GLOBAL BUSINESS ENTERPRISE: OPEN SYSTEM VIEW

2.1 Reality of Existence of Horizontal Management Structure

A global business enterprise is a socio-technical system. In reality, as a result of local environmental factors, its (business) components form *interactive value network* with their respective local market suppliers, competitors, affinity groups and customers.

In fact a recent OECD study explored the growing internationalization of production through global supply chains. Multinational firms base different parts of their operations in different economies to make use of comparative advantage. Foreign direct investment has increased the importance of international trade within firms. One-third of America's and Japan's total trade takes place within multinationals and their affiliates. The share of intra-firm trade is especially high in the IT sector, which is why the IT investment bust spread so rapidly around the world. Indeed thanks to the internationalization of production, a local market factor now has wider international effects than in the past even within a firm.

This is a transformation from the linear flow value chain of "standard" product seeking business model. As a result, each of its many component systems – marketing, planning, designing & detailing, decision making (statutory, administrative, technical and financial), manufacturing, production, operations & maintenance, sales, customers (local markets) – represents a distinct environment with its own unique goals, norms, and practices. Thus even when an enterprise is perceived to be a centralized system characterized by authority of a hierarchical, vertical management structure, the 20th century global business enterprise in the manner of interactive customer-supplier model *has*, as bitterly experienced by Cadbury management, horizontal spread across subsystems, which is characterized by local information origination and processing situation and decision making requirements that are distributed across many people, hardware and software components, management policies, financial mechanisms, etc. This sets the basis for delivering products customized to local markets for competitive advantage.

2.2 Information as function of Recipient

The above indeed is a statement of open system that a global business enterprise in actuality is. Specifically, a global business enterprise and its systems, sub-systems, and its components are "open" systems in that whatever else they do they necessarily process information, which is the function of source, process and recipient. A little elaboration is warranted here. When one says information is function of the recipient, i. e., local market, it is not natural to think of humans alone as recipient. Recipient can be machine, too; and in fact that is the main concern here. Undesirable design (information processing) implication as in case of the "Kashmir ad" could be attributed to meanings that local people gained from the ad. However, there is also a possibility of a resistor, which is capable of dissipating one watt, failing because local situation made it to dissipate two watts. Similarly, a mistake in a logic circuit design may result in a system giving an incorrect output for a local situation of given combination of inputs. And electromagnetic compatibility of a system may be compromised due to local changes of components during maintenance. Indeed, even if one takes a conservative view, a large, semantically complex, time-pressured, tightly coupled, high consequence, high-reliability engineering system, in the

wake of unclear goal statement (implicit goals inclusive), is observed to run a risk, in the fashion of an open system, of taking a life of it's own.

2.3 Global Product in Local Markets – Requirement of Informational and Physical Work Systems

Unlike closed systems that the “standard” product-in-high-volume seeking business models are, open systems thus have purpose (objective), possess porous boundaries with their environment, and process (import) information. With the technological reality of system integration, this makes for business activity (activity from local market environment included) *emphasizing* information and comprising informational and physical work systems in that it has a requirement to optimizes data and information for improved decision making for competitive advantage. Requirement is to maximize informational work (IW) comprising activities of: (a) originating from business process activities (both global and local) raw data/information in a complex and changing real world environment characterized by uncertainty and hence errors, and (b) processing this information on current basis for undertaking planning and evaluation of business process design alternatives and delivering selected information decision for control implementation at the physical work system.

3. MULTINATIONAL GROWTH – AN INFORMATIONAL VIEW

3.1 Principle of Internationalism

Internationalism is the principle of cooperation among nations for the promotion of their common good. At a theoretical level it offers a liberal basis for globalization, which views markets not as a place where profits are made but as a place where society advances in the common good. It suggests international economic integration is what happens when technology allows people to pursue their own goals and they are given the liberty to do so. If the technology advances to the point where it supports trade and subsequently investment flow across borders, and if people then choose to trade and invest across border, you have economic integration, and because people have freely chosen it this is a good thing. The axiom is again because people have freely chosen this course (a decision), there is economic benefit as well.

Economic and social analysts offer extensive arguments in support and against the visualization of international market but the remarkable success of the American economy during the 1990s - a success, which, thanks to globalization, has been seen and reflected upon all over the world – has made its acceptance by people at large world over a reality.

3.2 Early Statement of Internationalization of Markets

The modern American business enterprise has benefited immensely from the 19th century technological and economic innovations in the material processing system that sustains the American society, the result of which was the harnessing of steam power throughout the economy, from extraction and production to distribution and consumption. In mid 19th century this gave rise to four great trunk lines connecting East and West – the early statement of internationalization of markets. However, demands of increasing the regularity and speed of an entire societal processing system brought in first safety and then efficiency crisis on railroads.

3.3 Early Statement of Criticality of Information Integrity for Competitive Advantage

The case of a global product considered here is that of a rail transportation system. Specifically, Erie railroad, America's first great trunk line, faced increasing competition from the short lines along the Erie canal, which in 1853 consolidated to form the New York Central, thereby making that route more attractive for through traffic. This competition required Erie railroad to re-organize. What is significant is, accordingly, the management sought greater control over the railroad through *greater regularity and speed in the movement of information*. This was accomplished by means of a new hierarchical system of information gathering, processing, and communication designed to return control to the superintendent's office.

In the face of competition, although product management structure demanded that responsibility be formally divided and power distributed, the Erie management reasoned that the superintendent retained the responsibility for system-wide control, which was seen to be dependent on four informational capabilities: (1) the means of knowing whether such responsibilities are faithfully executed (method to recognize error occurrence); (2) great promptness in the report of all derelictions of duty, that evils may be at once corrected (speed and efficiency of processing error information and of error correction); (3) such information, to be obtained through a system of daily reports and checks that will not embarrass principal officers, nor lessen their influence with their subordinates (implementation of continuous error data base generation system while simultaneously ensuring management authority protection); and (4) the adoption of a system, as a whole, which will not only enable the General Superintendent to detect errors immediately, but will also point out the delinquent (integrity mechanism for control objective).

This indeed is an early statement of Information Integrity criticality for competitive advantage.

3.4 Organization for Structured and Periodic Information Processing for Distributed Decision making – The Basis for Global Business Enterprise

The Erie management introduced another significant innovation. For the successful implementation of the organization of above informational capabilities it specifically charged train conductors with the responsibility of reporting any deviation from rule by the engineman directly to the Superintendent. In other words control of the train became centralized not in the engineman, as was the case traditionally, but in its conductor, who had standardized detailed programs for starting and stopping the train and for responding to delays, breakdowns, and other contingencies. Seen from this angle, the conductors were the distributed decision making points, the decision alternatives to decide from and their information requirements being identified the a priori by *IS* designer (the Erie management in this case) exogenous to the decision situation. That is the decision process was "collective"; the structured and periodic information processed being recognized to be the function of "source" and "process" only and *not* of the local situation of decision and hence not amenable to any customization.

The conductors on the Western lines were possibly first white collared workforce in history to be used as programmable, distributed decision makers in the control of fast-moving flows through a system whose scale and speeds precluded control by more centralized structures. This use of human beings, not for their strength or agility, nor for their knowledge or intelligence, but for the more objective capacity of their brains to store and process information - that is to process structured and periodic information - would become over the 20th century a dominant feature of employment in the Information Society. Indeed, Chandler calls the Western's management structure "certainly one of the earliest organizational charts of an American business enterprise" and Beniger describes the Western's early use of systematically collected quantitative (error) data to inform decision making and control as operations research.

3.5 Global Business Model: Enterprise seeking "Standard" Product in High Volume

The 20th century multinationals, to achieve global reach, extensively implemented business information processing installations as above in the form of “computer applications”, implemented in non-integrated manner and generally justified purely on the cost reduction aspects of processing structured and periodic information. Thus today the likes of Western conductors are replaced in many of their functions by on-board microcomputers or, given modern telecommunications, by a more centralized means of computer control; and the requirements of integrity of information processed by the enterprise-wide computerized information systems are basically seen from the point of view of dependability and trustworthiness of the structured and periodic (what can be termed as fixed) information decisions to which the controls are tuned to optimize the performance of the physical (material and energy processing) work system. With the acquired global reach, what this has given rise to is a modern multinational enterprise adopting ‘top down’ strategies characterized by ‘working according to plan’, emphasizing ‘standardization’ and ‘keeping things on track’ – a “standard” product in high volume business model, so as to ensure there are ‘no surprises’. The requirement of business is in terms of automation of functions of ‘hard’ components so as to add value to the product and emphasis is on data integrity, process quality, efficiency and cost reduction for competitive advantage.

4. GLOBAL BUSINESS PROCESS IS VIEW FOR CUSTOMIZATION – INDIVIDUAL INFORMATION ORIGINATING AND PROCESSING SITUATION

4.1 Reality of Local Markets

Manufacturing sector world over offers good examples of such multinational enterprises. However, as hinted in Section (2) while discussing open system view of a global business enterprise, a little critical analysis of business systems tells something different; most manufacturing is *not* mass production based on standard product in large volume seeking business model. Even in the United States, the world’s largest center of mass production, 75% of the parts produced by metal working, for example, are in lots of less than 50 pieces. What this suggests is in reality manufacturing needs flexible automation – automation that can handle a large and constantly changing variety of produced items, i. e. customized products, which is a hallmark of the reality of existence of local markets.

4.2 Multistage Decision Process

In other words, even in case of a manufacturing plant, it really is not possible to achieve competitive advantage by merely processing a structured and periodic design (information) decision, which in fact represents a *collective* decision process. What is required is to originate the information consistent with the *use* (goal or relevance) as perceived by the recipient (the local market) and then process *that* information (for delivering the customized product).

Traditionally, the collective decision process is viewed to comprise stages of forecasting, evaluation of alternatives and selection; information being considered basically as function of “source” (i.e. as “data”) and at the most of “source” and “process” as is the case with “standard” product in high volume seeking business model. However, with information being function of “source”, “process” and “recipient” (i.e. local market or customer), more workable model of a decision process spans multiple stages. They are: based on long term goal set (by the recipient, i. e., local market), *obtaining* ‘many factors’ & ‘multiple criteria’ characterizing problem (task) complexity; from multiple criteria, *recognizing* (deciding) on operable goal; from operable goal statement, *defining* planning & design constraints and opportunity spaces; from ‘many factor’ information variables characterizing problem complexity, *culling out* useful (relevant) information variables; *recognizing* relationships (interdependencies) between culled out

information variables; *developing* state transition models defining dynamic behavior of culled out state (information) variables; and undertaking customized planning & design for *generating* alternatives for evaluation and final selection of flexible information decision for control implementation.

What is significant is this multistage *IS* view, among other processing, involves identifying operable goal, originating information, and generating alternatives, all, “endogenous” to *the* decision situation, that is, “endogenous” to the local market - a structural variant from traditional view of collective decision process, which (in the manner of a closed system) is concerned only with alternatives and information that are “already” generated exogenous to the decision situation (case of the Erie management). Thus, in multiple stage decision process based business *IS*, what we have before us, is an *individual information originating and processing situation*, which provides a design basis for customized global product in local markets.

5. REORGANIZING SYSTEM’S DEFINITION

If viewed from a physico-technical angle in which the system engineering discipline defines system traditionally, global business enterprise system is a “collection of objects united by some form of interaction or interdependence”. With identifying informational view for it (and the same can also be extended to its systems, sub-systems, and components), however, any such business organization system description is inadequate. Specifically, every material object contains no less than an infinity of variables (facts – data and, when processed, information), and, therefore, possible systems. In the event of the reality of localized internationalism of the market place, what is then required is to cull out – not necessarily physically, but mathematically – and study facts (data and information variables) that are relevant to the identified system goal (Usefulness factor) so as to design and deliver a customized product.

Within this framework of reorganization of systems concept and based on the *IS* view analysis of global business enterprise system as above, one can then define a global business enterprise system as a potential source of business information in respect of its systems, sub-systems and components, and describe it as a network of business information variables in causal relationship to one another and in situations even to themselves. Starting from requirements information origination to flexible design decision and implementation to customer service, the business process can be seen as the supply chain of a generic business process from concept to delivery. A competitive business strategy calls for a good understanding of business process, which in turn requires a good business model. Depending on the research need such models could emphasize different facets such as material, equipment, fluid, energy, money, information, etc. With a socio-technical character of business system characterized by open system view forming an intricate information network, as suggested in Section (2.3), this leads to is an information and control system model of which business process is an integral part (see Figure (1)).

6. STATEMENT OF CRITICALITY OF INFORMATION INTEGRITY

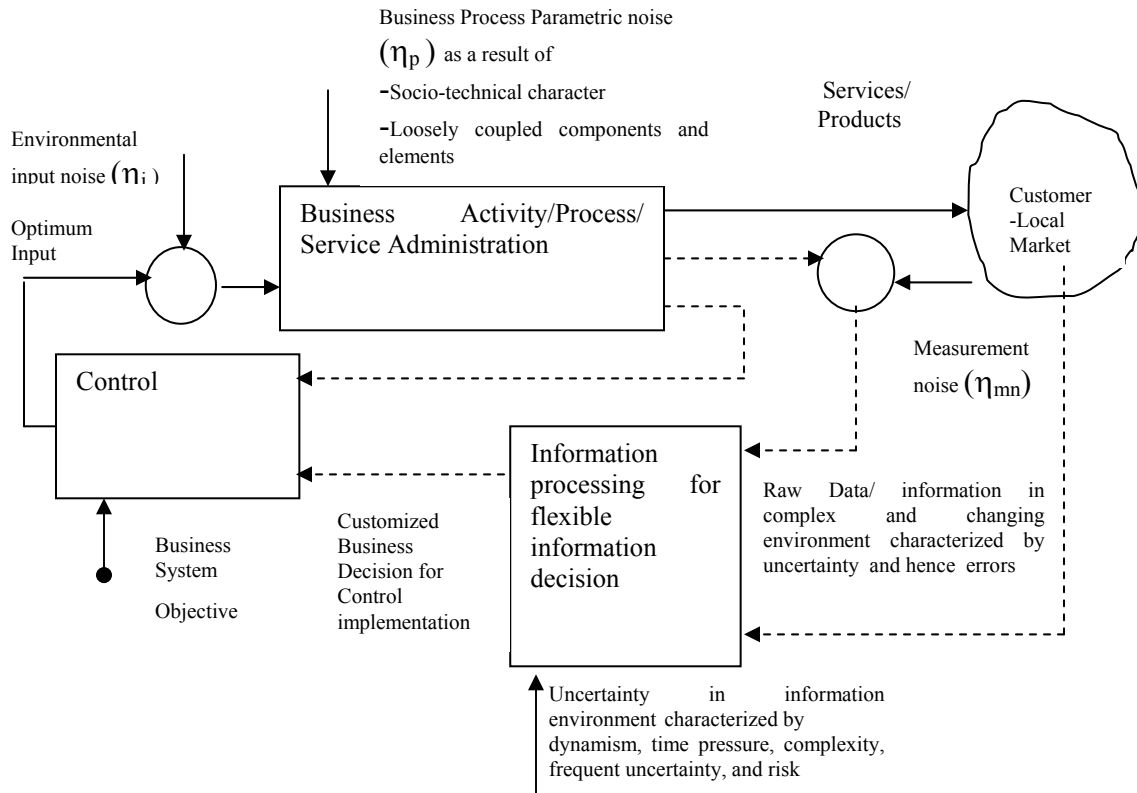


Figure (1): A systems representation of a generic global business process modeled as integral to a closed loop information and control system.

6.1 Global Business Process IS Error Implications of 5“C”

6.1.1 Complexity

As with traditional *IS* which is a “collective” decision process, this multiple stage decision process *IS* is also characterized by uncertainties due to system environmental factors of 5“C”, namely, complexity, change, communication, conversion, and corruption. As argued, modern business enterprise is a complex network comprising a large number of diverse, semiautonomous and interdependent informational components and elements (variables). The more the variables and greater their interdependence, the greater that system’s complexity. Complexity places high demands on the information system’s (*IS*’s) capacities to set operative goal, originate information, develop information structure dynamics model to integrate findings, and design effective customized actions; resulting in errors at various stages of the multistage decision process that the Business *IS* view is.

6.1.2 Change

As a socio-technical system, business service product is subject to change due extrinsic as well as intrinsic events: societal pressures, legal and regulatory rules, etc. Further, the business system must cope with very rapid advances in technology and practice. In this context, it may also be mentioned that change in the global business system is accomplished laterally across several subsystems in which decision-making are distributed across many people and units. In such a diffused system, change can be slow, often difficult process. There is yet another point of extreme significance: a system such as global business operates in the real world and it so works out that the real world is not passive but active; in turn invariably creating time pressures. All these change features leading to dynamics in components and elements of the business organization make it important to understand developmental tendencies therein. Further, it is not sufficient to observe and analyze (forecast) component and element information

variables at any single moment of time but instead it must be determined as to, over a time, whereto the whole system is headed (trend or directional information). These change factor related demands on business *IS*, resulting in further requirements of information originating and processing, contribute to errors in *IS*.

6.1.3 Conversion, Communication, and Corruption

Then, as mentioned earlier, complex, modern business enterprise involves many human and machine interfaces-cum-interactions between vendors, designers, developers, decision makers, production, operation, maintenance, people and devices, technicians and equipments, and others. There are also requirements of manipulation. All these introduce system environmental factors of conversion (consolidation, decomposition or transformation of data), communication (movement of data/information within or across enterprise) and corruption (poor motivation, desire for personal gain, carelessness, actions of people) in business *IS* environment. What is important for the investigation at hand is each encounter as this, indeed, each operation, technical maneuver, human-machine interface, or human and machine information processing presents an opportunity for error.

6.2 Business Process IS Errors are not Business Errors but rather Information Errors in Business Setting

It is these system environmental factors of 5“C”s, namely, Complexity, Change, Conversion, Communication, and Corruption acting externally as also internally, contribute to information errors at each of the multiple stages of decision process constituting the business *IS* view; in turn leading to loss of Information Integrity (I*I) in *IS* and in information there from. Research literature in information science reports an exhaustive category of hardware errors, design errors, software errors, communication errors, people errors, etc. Indeed, it is not one bit intention of the present research to as such list exhaustively the errors in business delivery system. But, what is argued is, in the light of the business system modeling based on informational view, it is important to realize that these supply chain errors are in fact due to information errors (at input (data origin) step, process (data transformation) step (medium comprising communication channel and people included) and at output (information use) step) through each of the multiple stages of decision process. Specifically, as explained in section (4.2), these multiple decision process stages are business *IS* view phases from initial business problem recognition (local operable goal setting) to undertaking customized (local market requirement centered) planning & design for delivery of flexible business service (information) decision for control implementation.

6.3 Business Process IS View: Continuous Individual Information Origination and Processing Situation in the presence of Uncertainty

In other words, business errors can be seen not as design errors, development errors, or marketing errors but as rather informational errors made in design or development or marketing setting in the local business environment. This modeling reality has a far reaching implication for the *IS* modeling exercise underway as what it does is to model information processing under the business *IS* view as a continuous individual information originating and processing situation in the presence of uncertainty, so as to account for demands of continuously determined specific goal based individual situation in a complex and changing environment. In other words, in view of open system character of the business *IS*, the requirement, in the presence of 5“C”s, now is to continuously originate, store, retrieve, validate, process, communicate, and store for future use or discard information.

6.4 Criticality of Information Integrity for Competitive Advantage

When local Cadbury India management made mistake of issuing wrong Kashmir ad in reality what went wrong? Did the process of ad design go wrong or is it the lack of skill or degree of accountability by those preparing it? These and such other causes are post-event observations. In fact, what went wrong is

the information item “Too good to share”, meant as directive, is assumed correct as validated earlier (for politically non sensitive markets). Similarly, when the resistor failed what went wrong is the information under specific application about supply and load is assumed correct as validated during testing; and when system gave incorrect output what went wrong is the information in the specific situation at that time on combination of inputs is assumed correct as it was known to be true earlier.

Speaking within the specifics of the news item describing the failure of the Cadbury India management, the question per say, therefore, is not of avoiding items with worldwide connotations in any ads connected with them (items) as the sources quoted by news item suggest, but that of *not anticipating information errors, i. e., loss of Information Integrity*. Management that anticipates such errors would implement systems that would continually undertake integrity analysis for the information that is originated and processed across the enterprise and also point out the cause for information error. Further what is significant is not only such control of Information Integrity will reduce occurrence of mistakes and hence avoid business losses, but ensuring desired Information Integrity would also facilitate developing new markets hitherto not considered; in either way the enterprise benefiting by achieving improved business performance. This makes continuous determination and control of desired Information Integrity (I*I) a *must* for efficient and economic functioning of *IS* so as to achieve competitive business advantage, thereby offering I*I as a bottleneck and, hence, as a critical resource for business advantage for global product in localized international market.

7. ORGANIZATION FOR CONTINUOUS INDIVIDUAL INFORMATION ORIGINATION AND PROCESSING UNDER UNCERTAINTY – THE DESIGN BASIS FOR GLOBAL PRODUCT IN LOCAL MARKET

For the successful implementation of the organization of above informational capability of efficient and economic processing of business process *IS* characterized by uncertainty, the *IS* specifically needs to incorporate integrity analyzers with the capability of generating and analyzing any deviation from standards in information origination, storage, retrieval, validation, processing, communication, *use* and subsequent storage or discard (as the case may be) under the *IS* and identifying its cause and of reporting it (deviation) and its cause to Integrity controller. In other words control of the business process should become centralized not in the information processing system (structured and periodic in that), as is the case currently, but in its Information Integrity controller, which will have detailed programs for:

- (a) Standardized statement of the *IS* Task (problem), which is obtained from the functional work activity of interest and which in all probability will be a complex goal statement having multiple criteria with many embedded information variables,
- (b) Standardized operable *IS* goal statements (performance standards that go to make complex goal statement as in (a)),
- (c) For each performance standard as in (b), standardized performance criteria describing performance standard (Criterion would normally describe “process” standards for *factors & measures, actions, optimality conditions*, and for *information reports* offering a mechanism to evaluate and measure if the product/service output (informational work included) delivered meets the performance standard, i. e., the expected operable goal),
- (d) For each performance standard as in (b), standardized performance evidences in the form of:
 - (i) Quantity and quality of product/service delivered over defined time period,
 - (ii) Demonstration of achievement of defined level of specialization in *IS* design and technology content,
 - (iii) Documented record of relevant, proven prior performance achievements defined with reference to the *IS* task corresponding to the operable goal,

- (e) Standardized information origination and processing methods,
- (f) Standardized information system environmental parameters covering relevant contexts, specificities or individual situations with respect to:
 - (i) Different decision process stages of *IS* as at (e), and
 - (ii) Standards as defined under (c), (d) above,
- (g) Standardized methods for reporting deviations from the standards at (c), (d) and (e). These deviations will be measured and reported as loss of Information Integrity (i.e., in the form of loss of Accuracy, Consistency and Reliability).

What is important to note is the Information Integrity controller here is designed to detect and correct errors in the information not only in respect of the *IS* (that is at (e)) but also in respect of information goals as to be seen by detection and correction of errors at (c) and (d). It is this facility ensuring goal integrity that goes to provide for Information Integrity controller the ability to reduce errors that creep in *IS* performance due to system environmental factors of 5“C”s, which characterize the local market. Understandably, even long-term goal statement would also have system environmental factors affecting it. In such case it follows that Information Integrity controller would have to be similarly designed for it by referencing to the higher-level complex goal of which the long-term goal set is a part. This then introduces in the Information Integrity controller the facility of directional adaptability for the evolution of *IS*; thereby suggesting control and adoption capability in the Information Integrity Technology design approach so as to meet the customization demand.

Thus Information Integrity Analyzers and Controllers constitute the technology to be used as programmable, distributed decision makers in the control of fast-moving changes (in local market objectives, their information requirements, interdependencies between the information variables, and their non-linear dynamics) through the business process *IS* view system of the information flow whose scale and speeds otherwise preclude control by more centralized structures. The Information Integrity Technology in the form of integrity analyzer and integrity controller would thus extend the capability of *IS* from that of information storing and processing (characterizing structured and periodic information processing) to that of information origination, storage, retrieval, evaluation, processing, communication, *use* and subsequent discard or storage for further *use* (characterizing unstructured and a periodic information processing). In other words the Information Integrity Technology would develop processing of unstructured and a periodic information processing under uncertainty as a powerful tool for optimization of informational work for global business processes delivering products under localized internationalism of market place, which in 21st century would occupy a dominant market space.

8.THE RESEARCH DIRECTION

For competitive advantage, every business must process matter and energy efficiently and economically. Information processing and programmed decisions are the means by which such material processing is traditionally controlled by the global business enterprises. This has been possible because successes in production automation sharply increased the volume and speed of energy conversion and material processing and thereby precipitated various structured and periodic information processing control responses mostly in the manner of a closed system view of organizations and their systems under the assumption of static environments.

Open system view of organization and economy offering accesses to bigger markets and, under the onrush of innovations in information technology, the volume and speed of information processing and decision-making undergoing sharp increases, organizations for their competitive survival have come to aspire bigger business opportunities. Whatever else open system does, it necessarily processes information. The business opportunity thus is in flexible (unstructured and a periodic) informational automation that has to “smartly” manage global informational requirement for a product in a local context. However, ever-present system environmental

factors of 5“C”s make the open system view of organization and traditional means of control in the form of information processing and programmed decisions infested with informational errors leading to loss of Information Integrity. Even if information technology innovations had been more gradual, due to 5“C”s, the ultimate result would have been same.

Information is higher order or derivative of matter and energy on which it depends for its existence and Information Integrity is its implicit goal. Loss of Information Integrity thus necessarily results in loss of efficiency and economy in energy conversion and material processing and hence in loss of competitive advantage. This makes Information Integrity, that is the trustworthiness and dependability of information, a key factor determining strategic business advantage. In other words, from the hallmark 20th century control strategy by global business enterprise of processing structured and periodic information, in 21st century the global business enterprise performing in local markets *is* required to pass on the control baton to controlling Information Integrity of continuous individual information origination and processing situation in the presence uncertainty (see Section (6.3)).

Continuous individual information origination and processing situation is an unstructured and a periodic information processing and carried out in the presence of uncertainty. But it is not a chaos situation that one is dealing with here. In fact what one is dealing with are informational work system activities of inductive modeling; namely, observation, verification, prediction of future states, precompiled responses and abstract reasoning, information decision planning, scheduling and implementation, coordination of activities via Information Integrity controls, reevaluation and resource management. It is designing for these informational work activities along with that (designing) for achieving the Information Integrity controls that then unfolds the Information Integrity research and knowledge space with reference to the task of designing and implementing for global products in local markets. Some of the specific (but not exhaustive) Information Integrity research issues thus emerging are:

- Information Integrity: Definitional Issues
 - Structure for defining Information Integrity
 - Usefulness-Usability-Integrity paradigm for an *IS*
 - Accuracy, Consistency, Reliability attributes of Information Integrity
- Modeling Continuous Information Origination and Processing Situation – A Theoretical Basis for Information Integrity
- Information Flow Models for Integrity Analysis
- Database design for Open System
- Uncertainty in *IS*
- *IS* Errors
- Developing Taxonomy of Information Integrity
- Information Integrity Quantifiers
- Designing Information Integrity Systems:
 - Information Development and Implementation Life Cycle (*IDILC*) Model Integrity
 - *ISDIL* Cycle Model Integrity
 - Content Integrity
 - Process integrity
 - Output Integrity
 - Medium Integrity
 - People Integrity
- Information Integrity Technology Design
- Analytical Framework for Information Integrity
 - Cost-Benefit Analysis of Information Integrity
 - Cost, Value and Risk elements

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