BUSINESS INTEGRATION GENERATING A NEED FOR INFORMATION INTEGRITY AN EXAMPLE -SUPPLY CHAIN MANAGEMENT

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ABSTRACT:

Purpose - The paper aims to discuss the Information Integrity issues in the wake of increasing business integration. It goes further to suggest an analytical solution and illustrate the same by applying it to Supply Chain Management

Design/ Methodology/Approach – In order to do the above the paper defines information integrity and suggests a model of Information Base Management System with an acquisition and utilization cycle attached. The model rests on an Information Topology Plane. The model also suggests a mechanism to originate the information in the acquisition and utilization cycle with a view to preserve information integrity.

Findings-Business integration is on the rise on account of increased usage of information technology systems. In wake of this situation the key issue is no more information manipulation, it is to ensure the accuracy, consistency and reliability i.e. information integrity. In order to achieve this Information Base Management System may be used, which encompasses an acquisition cycle, utilization cycle, Information Topology Plane and a method to originate information with a view to achieve information integrity.

Research Limitations- The research needs to be carried out further to crystallize the information integrity computation mechanisms. This paper goes up to identifying the method of generating Information Base Management System. The IBMS may further be used to compute an information integrity standard for each decision in a business process. This can be done using the error information base, which identifies the gap between the information base in the system and the environment as a basis for information integrity analysis.

Originality/Value- The paper adds authentic value as it suggests the need for information integrity in the wake of uncertainties arising in industrial management systems on account of increased automation and information technology usage. In order to do this it suggests a unique Information Base Management System and information origination mechanism for the same. An illustration of implementation of the model is shown using a lucid example of Supply Chain Management.

Key words: *Information Systems, Acquisition, Utilization, Business Process*

1. INFORMATION INTEGRATION IN CURRENT SCENARIO

In the industrial society, the strategic advantage came from use of power source, initially the steam engine and later the internal combustion engine or the electric motor. In these conditions, organizations sought "standard" product in high-volume-mechanical-manufacture based business models. These (models) emphasized material and energy processing, comprised physical work systems, and had their (models') systems, sub-systems and their components rigidly (as against loosely) connected. Complexity of the business system and that of market was that of order, viewed more as a linearly predictable (and, therefore, a static) entity. For example, the product design emphasized "standard", i. e, collective design information decision, which was insensitive to customer requirements of local market factor based ever-changing "individual" situations - sales model validated in a given market environment was considered transferable, i.e., linearly extendable, in another market environment without due consideration being given to (benefits or consequences that can be achieved or accrue) from variations in business system environmental factors such as objects (hardware as well as concepts), people, norms (standards), rules and procedures, instruction (software), financial mechanisms, policies, etc. In the form of applications such as accounting system, production system, inventory system, quality system, etc., the models had computerized information systems but they (information systems) processed structured (i.e., expectedly predictable) information and were generally justified (for competitive advantage) purely on the economic (cost reduction) grounds of reducing clerical work. Even when the organizations became aware of the information systems' potential for solving management problems of planning, direction and control, they (organizations) continued using information systems emphasizing collective decision-making processes, and there was no effort made to optimize data or information for improved decision-making for competitive advantage by way of increased market share.

However, with the technological reality of the data-driven technologies keyed to the flow of digital data throughout an enterprise and on the Net and with pressures of achieving business objectives of effectiveness and economy through requirements of mass-customization, agility-focused on customer responsiveness, IT driven market differentiation, supply-chain synchronization by integration maximization and financial optimization for strategic advantage, a business enterprise now has a need for utilizing data/ information decision 'smarter' by way of "individual" design information decision [Gulledge,06][Ariguzo et al, 2006] [Mandke,Nayar,2000][Kotzab, Skjoldager, Thorkil Vinum ,2003]

Specifically, what this 'smarter' design information decision requires is the production (origination or acquisition) of relevant normative (evaluative) maximal information in respect of local market factor based system environmental situations, without which the factual (source or process based) minimal information items traditionally retrieved from databases are distorted and incomplete and not useful for making improved design information decision.

As economy makes a transition from industrial society to the one based on knowledge and services, the key determinant is, thus, shifting from product quality improvement (as under the "standard" product in high volume business model) to individual design information decision improvement. In the turbulent business environment of today those business organizations will survive, which are able to make continuous design information decision improvement. The information they have will have to be the result of improved interplay between useful information systems and databases

Within the context outlined above, there is yet another issue - in addition to the uncertainty and judgmental factors at IS-human interface [Moray, 1994],[Mandke, Nayar, 1995] concerning the IS design methodologies that start from user needs (requirements identification) to giving her finished information systems and information there from for use by way of delivery of improved decision-making. Specifically, it makes databases deal with evaluative information items that are not only function of "source" (information in this form is normally termed 'data') and at the most of "process" (which includes medium of communication) but also of "recipient", i.e., user with the objective of improved decision-making. This again introduces new types of data inconsistencies and errors in the database. Because now the database does not only have the data being entered and stored, it has also to account for information origination and evaluation and for the errors arising out of the data origination and evaluation, processing it through channels (medium) for entering it into the database, and (for the errors arising) out of incorrect use of information [Mandke, Nayar, 1997].

In fact, with increasing use of computing and communication technology in IS and with incessant use of computerized information systems for global operations, system environmental factors of Complexity, Change, Communication, Conversion and Corruption (5 Cs) have started impacting the IS and databases, thereby introducing further data inconsistencies and information errors. These system environmental factors are outside the logical environment of the traditional database design view and, hence, errors (as a result of them) are not amenable to control by data integrity mechanisms controls normally considered at the DBMS design stage

2. INFORMATION INTEGRITY ISSUES IN BUSINESS

When modeled as function of "source", "process" and "recipient" with the objectives of improved decision for greater system effectiveness and economy, information acquires normative (evaluative) and factual components – a shift from information item requirement of mere factuality as in an existing database. Normative informational items are those which are not factual and use subjectivity for evaluation. For example for a product its identification number could be the factual information but the normative information for the product would be the one describing the product and its context to the current scenario for example – the vendor supplying the product, the product goal, the product utility etc. Both these information items are critical to useful decision-making and impart requirement that information originated, evaluated, stored and retrieved for improved decision-making is sufficiently perfect (non-distorted) and full (complete).

Information Integrity (I*I) of a set of information is then defined as the inverse amount of distortion (imperfectness, i.e., loss of goal, direction, objective, or value) and noise (incompleteness) present. Information Integrity is thus concerned with the correctness and exactness of the information. It is dependability and trustworthiness of information and controlling it is a key factor for determining strategic business advantage by way of delivering improved design decision. Its attributes are accuracy, consistency and reliability of IS and information there from. Information systems have changed a great deal but it is the processes by which these systems are designed and implemented that have changed the most. The majority of them are still comparatively simple in their design. But external as well as internal user aspirations – described through their respective environments - are becoming increasingly local and instant, requiring recognition of importance of environment as a major factor in decision making under complex and changing environment. This is calling for information origination and evaluation processes hitherto not considered. These processes (or rather absence of them) and uncertainties therein are contributing to ever-increasing importance of Information Integrity and its assurance [Mandke, Nayar, 2002]

3. PRESENCE OF OPEN DATABASES AND INFORMATION INTEGRITY ISSUES THEREIN.

Any business process, processes input into output for use by the user. Thus every business process works towards a goal. Thus a business process is a system and it has many subsystems which are systems in their own right, marketing, manufacturing, financial, personnel processes to name a few. Each of these systems plays a major role in planning, direction and control of the enterprise that is in management of the enterprise. Each system, subsystem in the business enterprise is actually processing information over and above the material and physical goods. Thus is termed as an Information System [Hoffer, George,Valacich, 2002]. The Information System may be an automated system or manual. However due to advent of technology most of the information systems are automated. Since these systems interact with the environment at large, they are essentially open systems. The concept of open system brings in the environment of uncertainty and judgment contributed by environments within and beyond the business system boundary.

The Information systems are always supported by information bases, as described above. Thus the information bases also need to be open to the environment. When they are exposed to the environment uncertainties due to 5Cs as discussed above they acquire the characteristics of an open system.

The analysis above has unequivocally brought forth the point that under the incessant requirement of system integration maximization and with the information technology for the same becoming a reality across the supply chain and on the Net; our information systems and, hence, database systems are getting exposed to uncertainties arising due to the constantly changing environment. The environment, that is, external to the logical environment of traditional applications and databases and which has never been the design concern. The databases that we have today are not only limited to being accessed within one organization. There are actually open, complex systems which can be modeled as networked, distributed or embedded databases covering data origin, processing and use stages as one is in a shared environment with users having access to stored data as designed by vendors. In other words, there is a change in IS and database Design View as shown in Figure 1.0 below

In fact we have a view of the database where it must be seen along with an acquisition, utilization cycle, and the context (i.e. environment) of its objective or goal. There is another perception to this statement, when we consider the data with its acquisition cycle, that implies that the data is being considered after it has undergone a process of acquisition. Thus the data residing in the database systems of yore actually transforms into information systems. Thus the Information Base Management System is being used in the following text.

Information systems and hence the databases lying there in are open systems. Information Base Management System as identified in above proposes to attach an acquisition and utilization cycle to the traditional information system/database view. This acquisition cycle should acquire information in order to maintain the integrity of the information base. The utilization cycle should ensure the utilization of information flowing in the system; it should also ensure that integrity is maintained from the end users' perspective. This brings in the question as to how this process be managed so that it will aid in decision making with integrity by using the information base of the acquisition cycle or by using the acquisition cycle to acquire more information.

4 INFORMATION BASE MANAGEMENT SYSTEM

The acquisition and utilization cycle

The following schematic depicts the systems view of above concepts.

Fig 2.0 depicts that given the summation of Information Integrity specifications, there are a collection of errors in the database. I*I controller checks these errors and modifies the decision process [Mandke, Nayar, Malik, 2001], [Gartner,1999]. The information base is both updated and current information in the information base supports the decision process. However the information base is not in tandem with the environment, there are gaps. These gaps find space as errors in the error database, which forms the basis of I*I analysis. This diagram is specific to acquisition cycle because with respect to environment, I*I controller is modifying the decision process and subsequently updating the IBMS AC (acquisition cycle information base) and error IBMS with the gaps. As stated above the error information base management system forms the basis of analysis for calculating integrity status [Börjesson. A ,2006] [Mandke,Nayar,1999]

Fig 3: Schematic depicting a system

Fig 3 depicts the informational view of any business system. As discussed earlier any information system goes hand in glove with a database. The schematic shows how the quality assurance processes in the IS are supported by the acquisition cycle information base. An important aspect depicted by this schematic is that quality of processes and product may be encompassed by an integrity information system database.

Fig 4 depicts the utilization cycle. This shows how the information flowing in the system is being utilized. Also it helps in checking the Information Integrity from the end users' viewpoint. It uses the acquisition cycle and also contributes to the development of the information base of the acquisition cycle.

Fig 5 depicts in a nutshell depicts how the IBMS will preserve the integrity of information by continuously acquiring and utilizing information. The entire IBMS will rest on the information topology plane. This is a flexible plane which can stretch with the requirements of the information system. The IBMS is said to be resting on the horizontal plane because the requirements are envisaged as an orthogonal structure. Slicing it for understanding of various data elements will make this planar structure. On this plane are embedded various data elements, which depict the contours of information in the real world. On this contours we will base the acquisition and utilization of information for data elements.

5. THE INFORMATION TOPOLOGY (IT)

Environment comprises of information systems and information variable. It has people, software, communication, norms, rules, procedures, financial mechanisms and object like hardware, concepts. Living organisms, organizations, systems and businesses that IS they are, experience uncertainties in respect to their environment. These uncertainties bring about threats, risk and opportunities. It is by originating information that systems can reduce threats and risks and on the other side increase opportunities. Information constitutes as the only workable mechanism by which systems, their subsystems and their components cognize respective environments. This environment is synonymous with information and its requirements.

The real world problems are open ended problems, and by no means, a complete problem can be comprehended and solved. IS developed and deployed in a specific environment is always confronted with such open ended problems, as a result of the uncertainties in the environment. A blind eye to such problems results in significant drop in the effectiveness, economy and efficiency of IS. The designer of an IS thus has to draw a boundary to focus on that particular problem (problem information), making some environmental factors internal while others as external to the system. The traditional design of IS is done in isolation, assuming the environment to be static, not considering the dynamism of reality. But for competitive advantage the IS with integrity should be designed which should consider the evolving, conflicting and ever-changing environment. This calls upon for the designer to anticipate various environments where the IS would be deployed in and also of the neighboring IS which have direct and indirect impact on that IS.

Information Topology is an abstraction from the environment discussed above. It is developed through an iterative and continuous process of information origination, evaluation and processing.

6. ATTRIBUTES OF INFORMATION TOPOLOGY (IT)

It is enriched with information envelope [Mandke, Nayar, Malik, 2001]. Each layer has informational processes and decision mile-posts. That is to say that how much of information should be originated in the topology. To this the answer is that corresponds to the information requirement of the dynamic decision stages.

Figure 6 throws light on three attributes to build the IT. They are environment, informational requirements and (I*I Rules) decision stages. The informational requirements identified during the projects are as follows-

Normal, standard requirement: Requirements are either given by the customer or assumed by the supplier, mostly latter. (Customer can be external as well as internal, internal customer coming into the picture when business process undergo changes due shift in data driven technology application across the enterprise-wide supply chain.) Given this it is common for supplier to assume normal, standard requirements for a customer with assumed eligibility criteria. However, there are issues, what-if eligibility not satisfied? Should that mean no consideration of that customer? For example, for product sale, supplier may assume that customer is eligible who has money with him at that time. What-if the customer is not having money? What additional requirements supplier must anticipate, ex-ante, so as to not to loose that customer and not suffer business loss. In other words, it should be useful to define along with normal, standard customer eligibility requirements, requirement with marginal eligibility deficiency. There can be other requirements as well such as:

- Requirements with deficiencies.
- Shifting requirements i.e. shifting in conceptual objects which can be
  - Informational objects, mainly to be found in service sector.
  - Functional Objects – desired and maintainable.
  - Performance based objects.
- Requirements acceleration.
- Requirements delaying.
- Requirements coming with delays
- Transfer of requirements, horizontal, mobility of requirements
- Combination of requirements.
- Requirements with vertical mobility, telescoping(moving from lower level requirements to higher level requirements missing out on some in between subsequent levels)
- Decline in requirements.
- Evolving requirements – changing priorities.
- Conflicting requirements, complex requirements.

This view of requirement is pregnant with design bases for error tolerant Information bases with Integrity [Khurana, 2005].These requirements transform into the goal set at various decision stages. These goals sets then need to be stored in the information base. Subsequently to meet each requirement (transformed as a goal set) data should be accumulated (originated and acquired). How far the requirement is met and how much more data is required in the design bases is then calculated, acquired and utilized. Process of transformation goes through various decision stages. The decisions stages can be identified as D0-D22. They are being enumerated as D0-

D22 so that classification in to groups can be made:-

- D0 – Obtaining current basis data/information on requirements of: (a) Recipient (customer) under consideration (covers objects [concrete, abstract], humans, rules, norms, commands, etc.), (b) Business process costs and capabilities, (c) Questions, etc.
- D1 - Based on long-term goal set, determining Positive/Negative Goals, General/Specific Goals, Clear Goals, and Implicit Goals.
- D2- Transforming Negative Goals into Positive Goals.
- D3 - For Positive Goals identified, setting Intermediate Goals.
- D4- For the problem solving situation, identifying environmental anomalies or malfunctions that will emerge with delay.
- D5 - Given the malfunctions that will come with delay, determining what must remain unchanged, i.e., identifying environmental anomalies that must not occur in the process of problem solving.
- D6 - Based on (D5), delineating multiple goals to make implicit problem solving goals explicit.
- D7 - Based on Specific Goals (D1), (D3), (D5) and (D6), determining many factors and multiple criteria.
- D8 - Based on [(D3), (D5), (D6), and] (D7), determining independent goals.
- D9 - Based on (D8), deciding delegation (contracting), identifying uncertainties in delegated decision-making, and deciding operable goal statements.
- D10 - Based on [(D3), (D5), (D6), and] (D7), determining information about interdependent goals, which are positively linked.
- D11 - Based on (D10), selecting central goal from amongst positively linked goals and deciding operable goal statement.
- D12 - Based on (D10), deciding ranking of positively linked goals without time pressure and selecting operable goal statement.
- D13 - Based on (D10), deciding ranking of positively linked goals with time pressure and selecting operable goal statement.
- D14 - Based on (D3), (D5), (D6), and (D7), determining information about interdependent goals, which are negatively linked (i.e., conflicting goals).
- D15 - Based on (D14), choosing, from conflicting goals with uncertainty, the operable goal statement.
- D16 - From formally operable goal statement, defining planning & design constraints and opportunity spaces.
- D17 - From ‘many factor’ information variables characterizing problem complexity, culling out useful (relevant) information variables.
- D18 - Recognizing relationships (interdependencies) between culled out information variables
- D19 - Developing state transition model defining dynamic behavior of culled out state (information) variables.
- D20 - Within the framework of opportunity and constraints’ spaces (D16) and based on the state transition model (D19), undertaking customized planning & design (i.e., unstructured and a periodic processing of factual information continuously obtained on current basis for the problem at hand (Section (4-f))) for generating alternatives for evaluation.
- D21 - Evaluating alternatives generated at (D20) for their contributions to operable goals.
- D22 - Selecting flexible information decision for control implementation.

The environment would comprise of objects like

- People (like stakeholders, external user and internal user).
- Hardware.
- Software.
    - Requirements, analysis, design, development, technology (networks, web etc), testing, implementation, maintenance procedures.
- Norms.
- Policies.
- Rules.
- Procedures
- Concepts.
- Financial Mechanisms.

I*I rules in the fig 6 encapsulate the decision stages. Every data element in the database is basically these informational variables, characterized with performance standard, performance criteria and situational value. The origination processes are identified as per the information envelope [Mandke, Nayar, Malik, 2001]

6. ARCHITECTURE OF IT

As the result of considering the above stated mile-posts, we obtain a multi-layered IT. The layers can be infinite in number but here we consider three for the understanding of the concept.

Layer 1: Problem Information.

Layer 2: Problem Environment Information.

Layer 3: Alternative Information.

Figure 7 illustrates this concept.

Layer 1: Problem Information defines the problem. It clarifies or articulates the needs that must be met. The planning process of problem information has following four processes and their respective decision mile-post, namely,

- Analysis of needs.
  - D0.
- Determination of objectives.
  - D1-D7.
- Operational definition of objectives.
  - D8-D15.

Layer 2: Problem Environment Information reveals the opportunities and constraints that open or restrict the range of possible solutions and the general environment conditions, which will affect the contributions any potential solution will make to the various objectives. This layer consists of information about environment in which the problem is stated and would be deployed. The planning process of problem environment information has following two processes and their respective decision mile-post, namely,

- Basic studies: resources potential and needs.
  - D16-D17
- Analytical model.
  - D18.

Layer 3: Alternative Information is used for evaluating, selection of flexible information decision. The planning process for production of alternative information and decision mile-posts are:

- Systems synthesis.
  - D19-D22.

The layers are enriched with Information Envelope as shown in the fig 6 above. It is useful tool for information origination, evaluation and processing. Therefore, in developing problem information (Layer 1), first it is important to recognize that information is an envelope of values, objectives, goals and facts. Secondly, given long-term information, it is further required to obtain information in respect of operable value, objectives and goals' statement. In other words, one can originate information by defining long-term goal, many factors and multiple criteria, intermediate goals to account for problem complexity, independent goals, operable goals, interdependent goals, ranking and prioritization and conflicting goals.

7 DEVELOPING IT

The decision mile-posts D0-D22 helps in developing the multi-layered topology, by identifying the information variables at each stage, which is recognized as information origination. The designer continuously, pumps information until the IT's I*I value reaches one. I*I value is 'one' means that the information is perfect and complete as per that particular Solution. If the value calculated is 0.8 then the risk, this IS faces is 1 - 0.8 = 0.2.

The IT plane and the Acquisition Cycle

Need is for developing database, given complex and changing environment and requirements. This calls for database model adjoined by acquisition and utilization cycles. In abstraction, these cycles are information evaluation cycles, information evaluation implying information origination and evaluation. The traditional database models which are basically information storage and retrieval facilities do not emphasize information evaluation .

Acquisition cycle evaluates information from the designer or the supplier end so as to deliver flexible information decision for customer satisfaction with competitive advantage. It covers IS and information corresponding to decision processes, D0-D22. Acquisition Cycle is an information origination and evaluation process which improves integrity of data model, by assimilating data/information elements from the IT to develop information network (interconnection of data elements in an information topology plane) with the help of decision mileposts (D0-D22). These decisions mileposts are categorized under the following layers namely, Problem Information, Problem Environment Information, Alternative Information (fig 7)

8. THE IT PLANE AND THE UTILIZATION CYCLE

At the end of the acquisition cycle, quality assurance process and functional processes the product is delivered to the customer. For example, the course is designed for a particular degree, and the teacher teaches it. Now, it is equally important that the student cooperates with the teacher in course delivery. This example conveys that the customer is an active entity with of the IS delivered. Utilization Cycle recognizes that the customer has her own information processing environment and would use the product as per her convenience. Keeping this in mind the UC contains all the decision mile post from D0-D22, giving flexibility to the customer to operate within the confines of the designer boundary. Integrity of this UC must also be ensured.

9. ILLUSTRATIONS OF IBMS REQUIREMENT FOR ACHIEVING I*I IN SUPPLY CHAIN

All businesses need a supply chain. With more and more focus on consumers, the supply chains also have to undergo a change in terms of mass customized supply chain [Zeng, Phatak, 2003].

A mass customized supply chain is more complicated than a supply chain which provides a mass manufactured standardized product to the customer [Faisal, Banwet, Shankar, 2006]. This is because mass customization is not just for satisfying the unique needs of different customers but also for satisfying the needs of the customer which are changing due to a changing environment. Requirement changes may be due to the changing policies, fluctuating market, rising competition or could be with in the supply chain in terms of malfunctioning production unit or an occupied warehouse [Agarwal, Poo,2006] Moreover, it is not only the end user who is the customer; any entity within the supply chain may be a customer. The production unit could be a customer to the supplier and the warehouse customer to the production unit. In other words, there is an internal customer at every step in the supply chain who is surrounded by an environment adding to the uncertainty generated by the outside environment. Thus, the performance of the supply chain is not only impacted by the environment surrounding it but also by the component's environment within. The predominant information and material flows in a mass customized supply chain are schematically depicted in figure 8. The information flow commences with an order from the customer to either the retailer or the marketing department of the manufacturer. This is transmitted to the design section from where the required design information is sent to the production department. In turn, the manufacturing department sends a request for raw materials or components to the purchase department which places an order with the supplier. The material flow starts with the supplier sending material to the purchase department which issues the same to production. The finished product is sent to the warehouse from where it is dispatched to the retailer from whom the customer collects it. This situation is complicated as compared to the supply chain producing a standardized product since the product configuration keeps changing here. Moreover, due to changing environment, the information requirements become further complicated as discussed above, where in the requirements can be with deficiencies like incomplete order of a product, shifting wherein the customer is unable to decide what is the design of the product that he wants or accelerating wherein the requirements keep growing like services required are difficult to design etc.

They are impacted by environment at every stage. Environmental impacts can be due to system environmental factors of 5Cs (complexity, change, communication, conversion, corruption), this information and control system constituting business process information base view is characterized by uncertainty at various levels as described here. The internal environment also impacts the supply chain, as within each component there are sub components which interact with each other. Each of these subcomponents in turn is themselves affected by the environment, thus creating an internal environment with noise. In fact at each decision stage of supply chain the information needs to be stored and integrity maintained therein. These decision stages are discussed as D0-D22 in the Information Topology explanation. Thus there is a need for an information base with integrity at each stage, which will consider these decision stages. Fig 9 depicts the same.

As explained above the IBMS need to be supported with an acquisition/utilization cycle.

10. THE IBMS FOR A SUPPLY CHAIN

THE INFORMATION TOPOLOGY (IT) PLANE

The Information Topology Plane for any supply chain should consist of all the data elements in context. Like the Suppliers, Customers, Purchase Department, Manufacturing Department, Design Department, Warehouse, Marketing and any other related entities [Li-Ling Hsu, 2005].

10.1 ATTRIBUTES OF INFORMATION TOPOLOGY PLANE

The attributes of Information Topology Plane are environment, informational requirements and (I*I Rules) decision stages. In the case of a supply chain these attributes would comprise of the environment of all the data elements in context as shown above. In order to capture the environment of the data elements the designer would need to capture the factual as well as normative information. What normative information needs to be originated is determined by the requirements and the decision stages. For example the requirements can be mapped to decision stages like

D0: Obtaining current requirements of the customer

Obtaining business processes costs and capabilities. The business processes here could be from placing the order of the product, designing the product, receiving the product, manufacturing/assembly line of the product, marketing/retailing the product.

D1: Long term goal set of the supplier, customer, departments, companies etc. These long term goal sets would then transform into negative/positive goals. For example if the long term goal set of the supplier is to be an international player then how has he positioned himself for the same, would he be ready to negotiate the prices, what is the quality of the product he offers etc.

D2: Transforming negative goals in to positive goals.

In case the supplier has a long term goal set of being an international brand, then if he has priced his product higher is a negative goal. Transforming this to a positive goal in terms of buying bulk quantities at relatively lower prices or buying at higher prices with international quality standards.

D3: For positive goals identified setting intermediate goals.

If the positive goal as in the example cited above is to purchase bulk products at a higher price then the intermediate goals would be to adjust the reorder levels and dates.

D4: For the problem solving situation, identifying environmental anomalies or malfunctions that will emerge with delay.

In this case the environmental anomalies could be that the product is not available with the supplier, or else it has not been consumed by the manufacturing assembly line and hence the reorder for a bulk quantity cannot be made at lower prices.

D5: Given the malfunctions that will come with delay, determining what must remain unchanged, i.e., identifying environmental anomalies that must not occur in the process of problem solving

In the example being cited in case the bulk product is not available would the supplier be changed or else another alternative supplier has to be appointed.

D6 - Based on (D5), delineating multiple goals to make implicit problem solving goals explicit

In case another supplier is not to be appointed than what are the intermediate goals to ensure that the supplies are received from the same supplier in a give time frame. How much time and money can be put in to reserve.

Originating information in this suggested manner will ensure that the implicit problem solving becomes explicit and information is pre originated for any unforeseen requirements.

D7 - Based on Specific Goals (D1), (D3), (D5) and (D6), determining many factors and multiple criteria

In line with the example being discussed normative and factual information would need to be originated for the

i) D1: In case the supplier wishes to be an international brand than what are the many factors and multiple criteria for him to reach this stage. For example how many other suppliers are there in the market, what is the unique selling proposition of this particular supplier, what are the process standards being followed.

ii) D3: In case the reorder levels need to reworked for a particular product for a supplier, what are factors on which these reorder levels are dependent upon.

iii) D5: In case the supplier needs to be changed that what is the process, in case another alternate supplier needs to be appointed than what are factors to determine the same

In a similar way the desired number of decision stages need to be spanned for all the data elements in the information topology plane.

All these decision stages will originate information within the acquisition cycle of the Information Topology plane. Similar decision stages need to be spanned for the utilization cycle.

All the information originated thus would populate the Information Base Management Systems at each level.

The ensuing decisions in presence of all this information would be with a higher Information Integrity level. This can be measured by the reducing errors in the Error Information Base shown in Fig 3 & 4.

11. CONCLUSION

In the scenarios discussed above the need for information base design which preserves integrity has been brought out. It has also been shown that the traditional database design along with acquisition, utilization cycle and resting on the information topology plane would form the basis of this information base design which preserves integrity as well. These information bases would contain the decision stages D0-D22. These decision stages actually comprise I*I rule set. The need and the sample implementation of the Information Base Management System has been shown in the Supply Chain.

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i : Current closed system view of the database

ii: The proposed open system view of the database

Figure 1: Current and proposed database Views

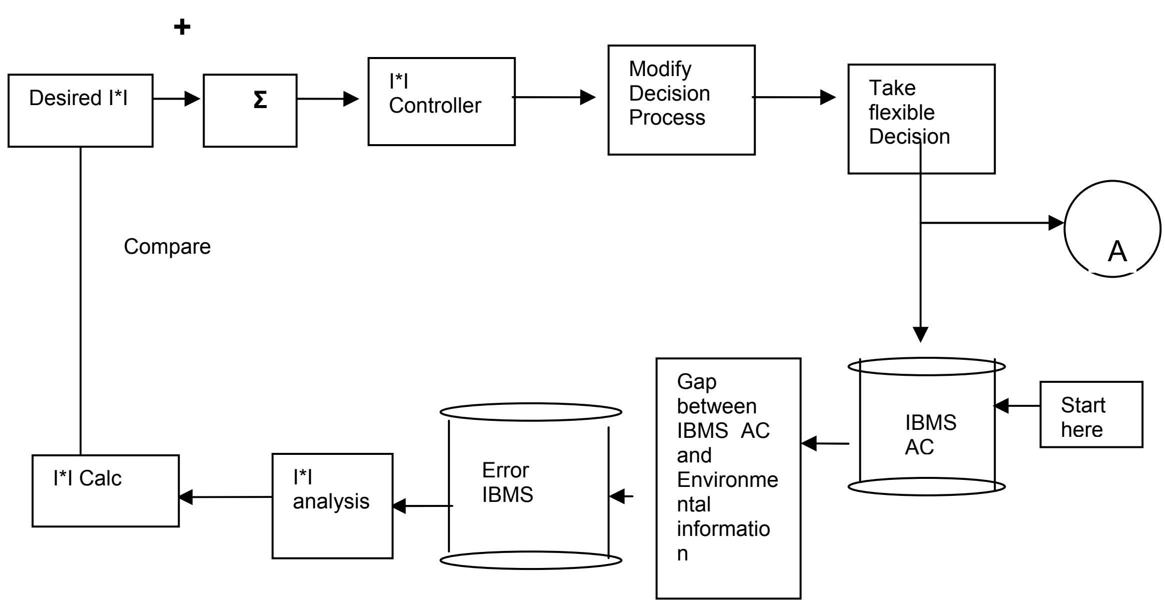


Figure 2 : The acquisition cycle

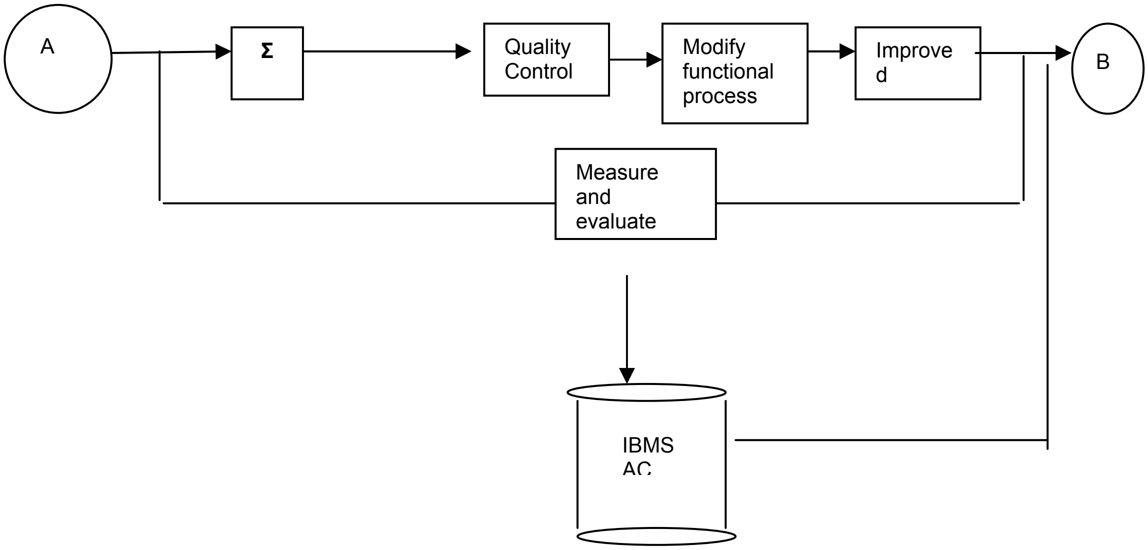


Figure 3: Schematic depicting a system

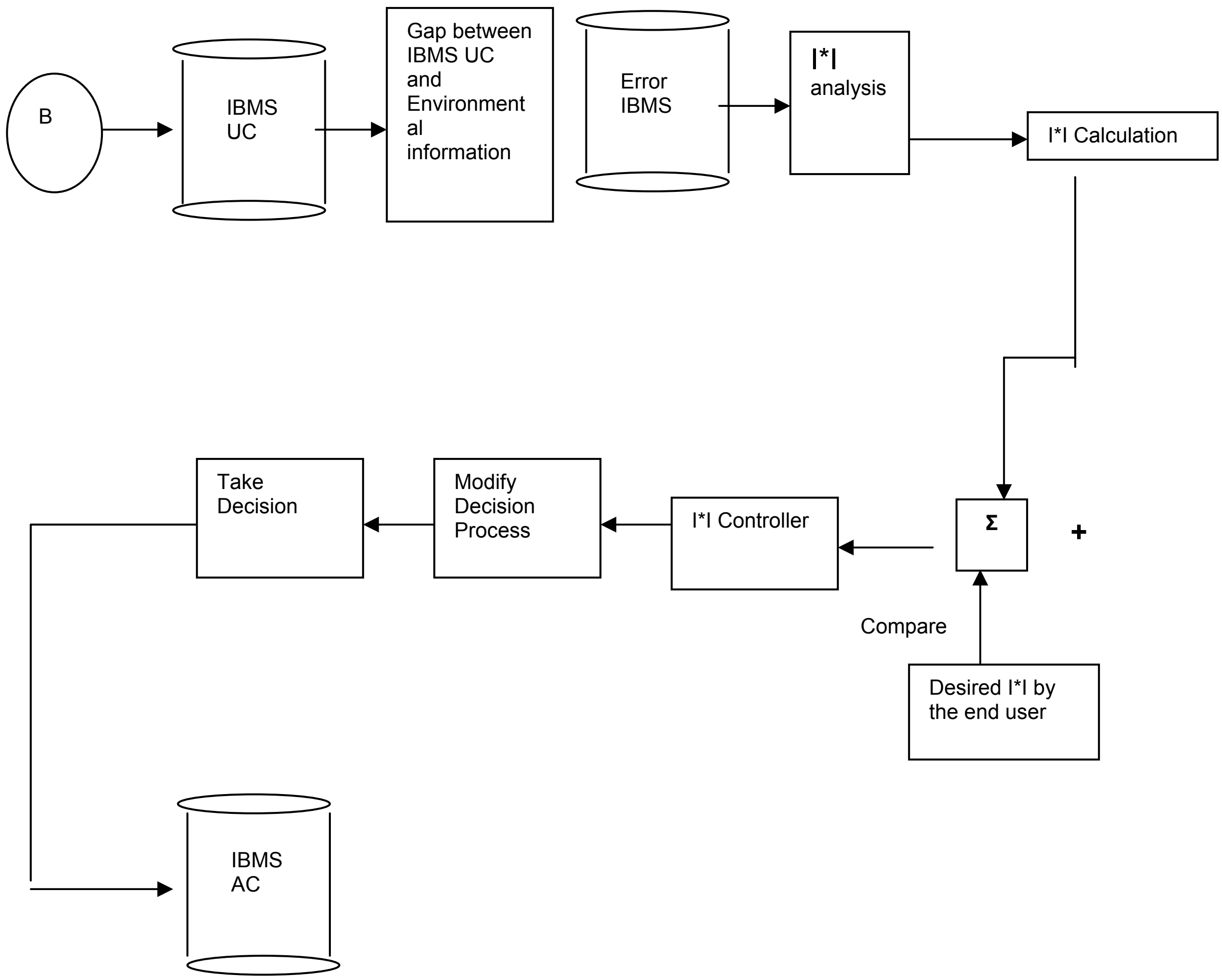


Figure 4: The utilization cycle

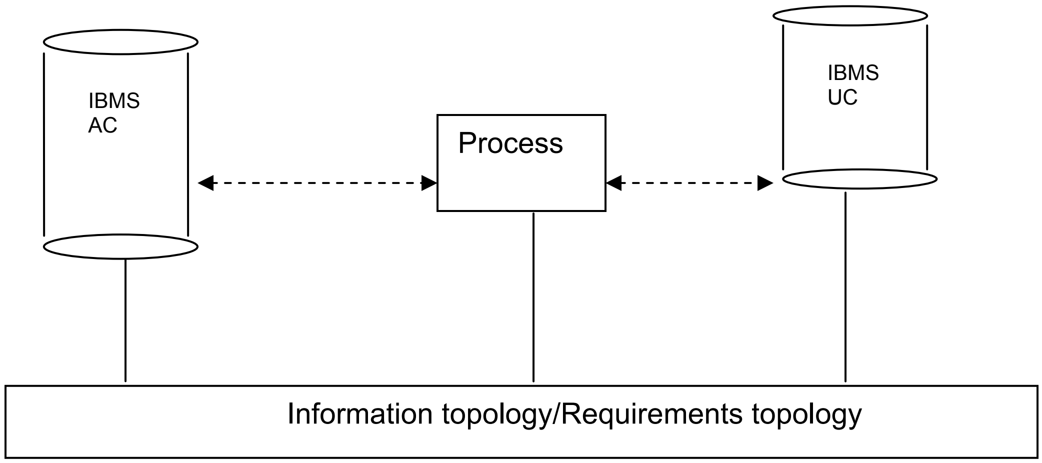


Figure 5: Schematic depicting the IBMS

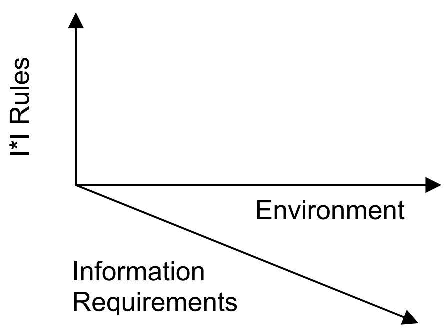


Figure.6: Attributes considered for ET/IT

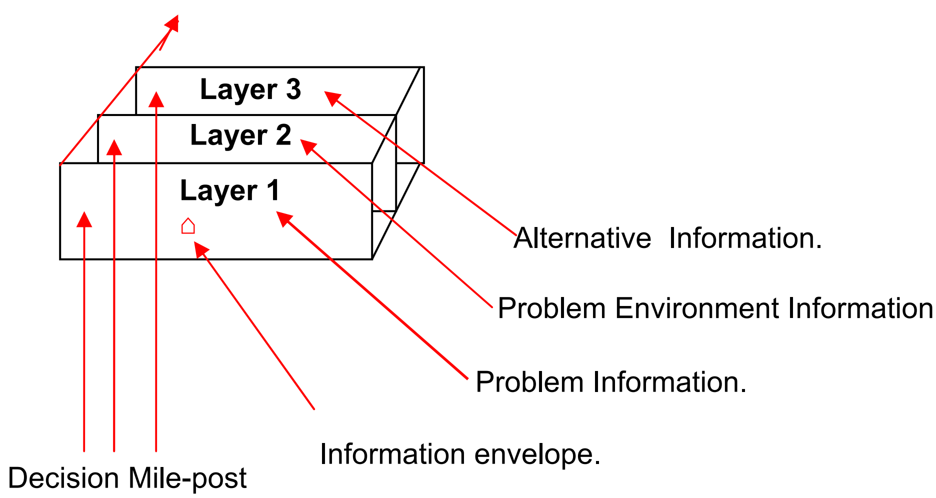
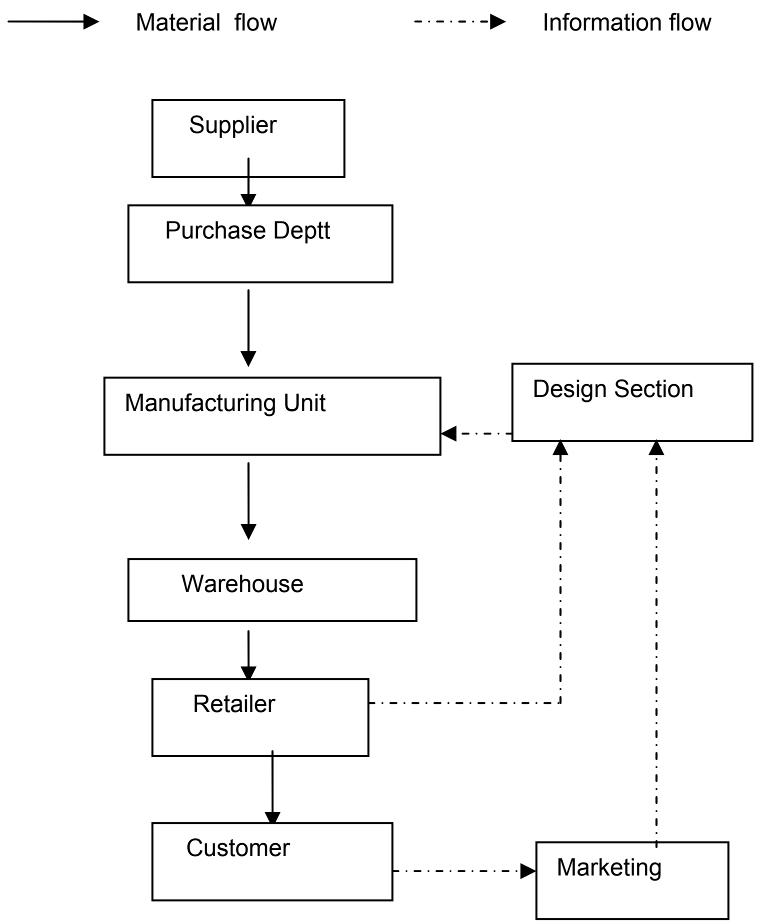


Figure 7: Architecture of IT.


Material flow
Information flow
Supplier
Purchase Deptt
Manufacturing Unit
Design Section
Warehouse
Retailer
Customer
Marketing

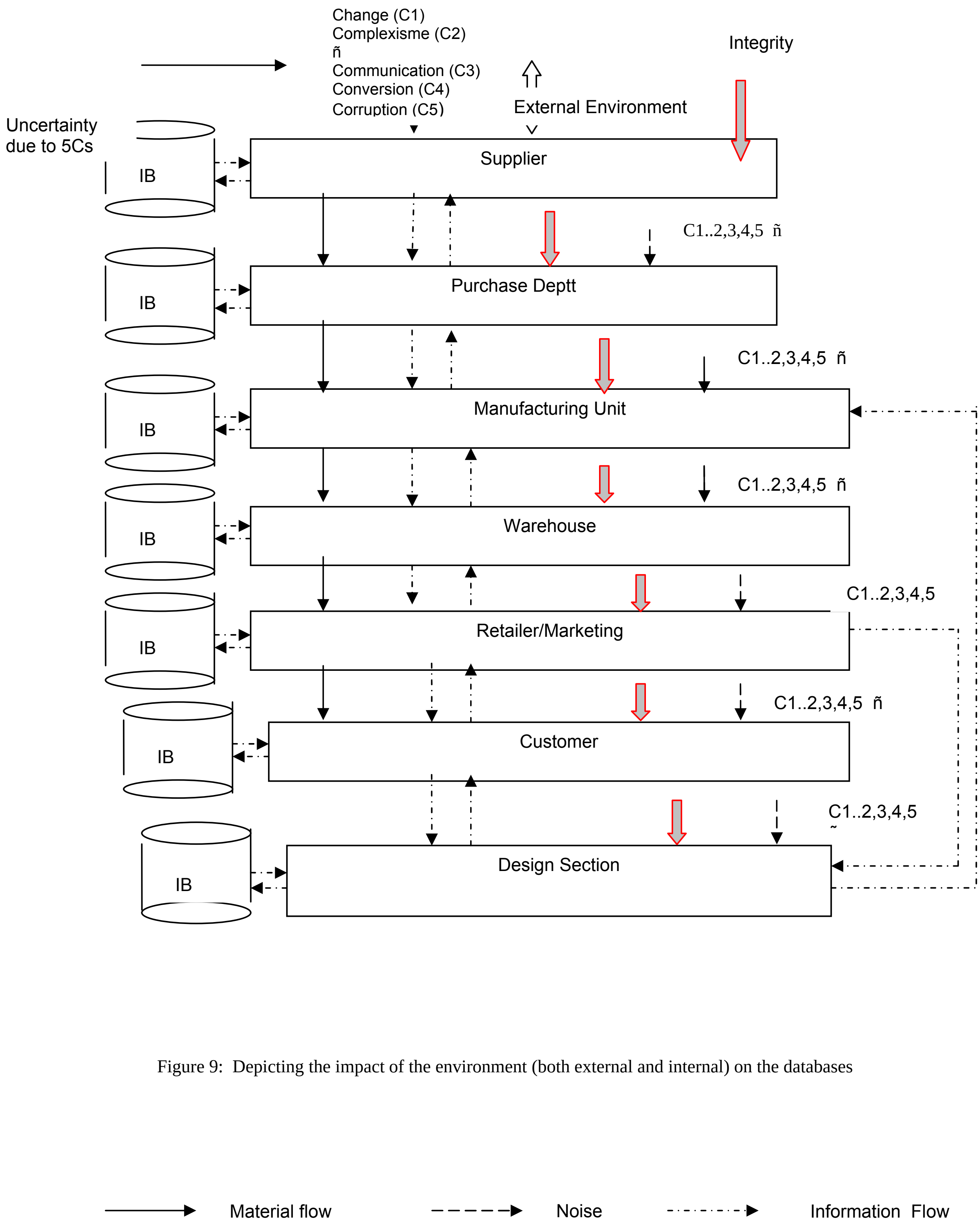


Figure 9: Depicting the impact of the environment (both external and internal) on the databases