18

Futurescope 2020: Global Management Support Systems in the Knowledge Age

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The rapid evolution of information technology (IT) has drastically changed organizational problem-solving and decision-making. Innovation and the free flow of information are considered the primary drivers of the accelerating pace of change in the global business environment, an environment characterized by great uncertainties ignited by opportunities and threats. The environmental forces of change have altered the rules of management to utilize information and knowledge in lieu of data in problem-solving and decision-making.[1] Managers face challenges as they strive to add value to their organizations' bottom lines. The gut instinct management style is history. Today's business leaders must acquire real-time information across many time zones, adopt algorithmic decision-making techniques and use highly sophisticated technology to run their organizations effectively and efficiently.

The industrial age paradigm of replacing human labour with machinery gave way to the information age that shifted the focus away from the production of physical goods and toward the manipulation of information. The information age has emerged into a knowledge age. To be successful in the knowledge age, organizations must recognize this on-going transition and prepare their processes to leverage knowledge. Global management support systems (GMSS), based in concept on the closely related fields of information systems (IS) and operations management (OM), may provide comprehensive and integrated support for problem-solving and decision-making in the knowledge age.

Data, information and knowledge in the knowledge age

Over the last several decades, a philosophy and a body of intuitive and analytical decision models have been developed to help decision makers
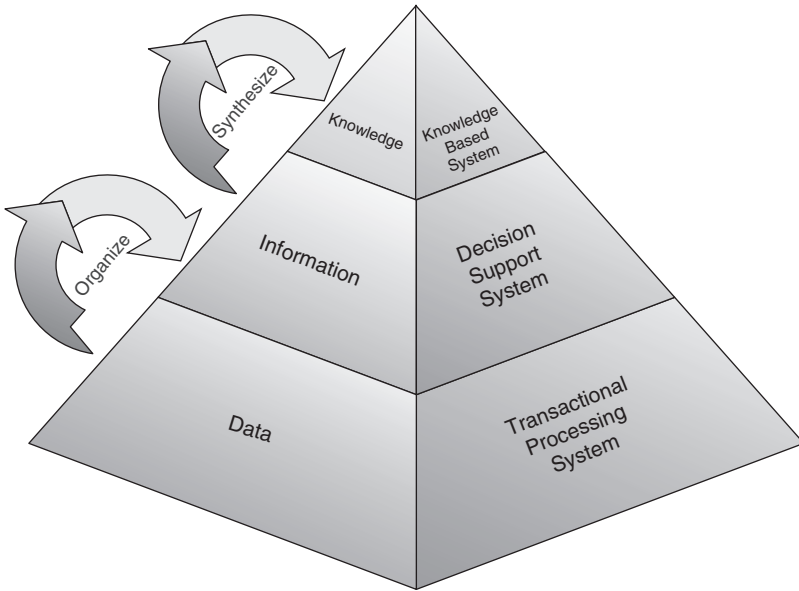
Figure 18.1 Information system pyramid

decompose, synthesize, and solve problems. Pivotal to problem-solving and decision-making in the knowledge age is the processing of data, information, and knowledge. Data are a collection of bits, bytes, and characters; information is derived from organizing data; knowledge is extracted from synthesizing information. Raw data by itself have few or no applications. No decision may be made without first organizing and synthesizing data. Figure 18.1 presents the evolution of data and its relationship with information and knowledge, visualized as a pyramid of interdependent layers on the top of each other with data at the bottom, information in the middle, and knowledge on the top.

Computers, more specifically computer-based information systems (CBIS), are used to collect, store, and process (organize and synthesize) data, information, and knowledge. Data are collected by a transactional processing system (TPS) and stored in a database management system (DBMS). Data are organized into information by a management information system (MIS) and used in a decision support system (DSS) for decision-making. Information is synthesized into knowledge by a knowledge based system (KBS) and used in an expert system (ES) for problem-solving.
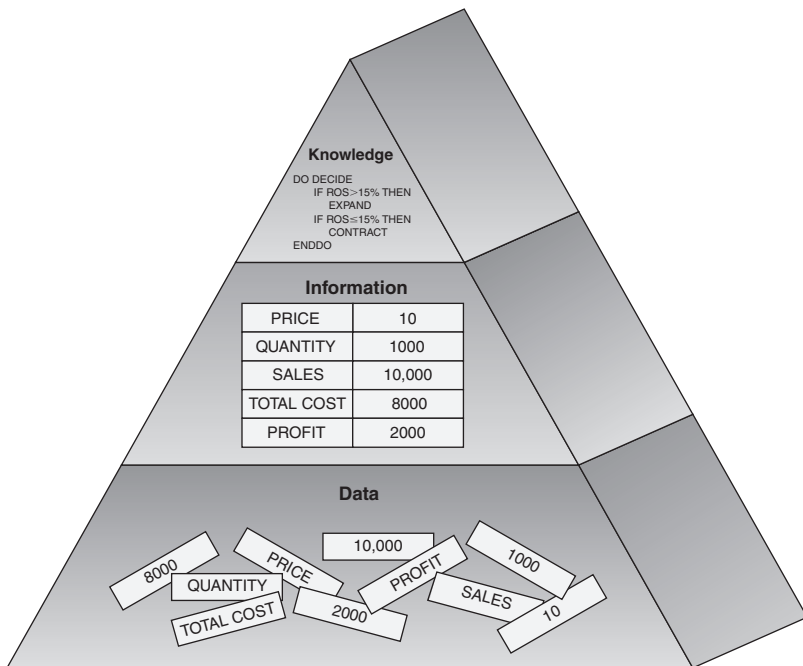
Figure 18.2   Data pyramid

Consider the pyramid in Figure 18.2 where a retailer collects data on revenues and expenses for every purchase expense. Those data are then stored in the retailer's DBMS. The accounting department may retrieve and organize these data into meaningful information by way of a report such as an income statement. The operations department may use this information in a DSS to assess profitability. The finance department may synthesize this information in a KBS and make expansion or contraction decisions.

GMSS have emerged as a force in global managerial decision-making. GMSS are integrated DSS that use data in conjunction with analytical and mathematical models as well as a user interface to solve complex problems and provide calculated solutions to human decision makers.

Decision support systems in the knowledge age

There is a significant amount of evidence that intuitive decision making is far from optimal and it deteriorates exponentially with problem

complexity. GMSS, as an integrated DSS, support decision-making activities by utilizing analytical tools and databases to formulate, visualize, and interactively analyse semi-structured and unstructured problems that require human reasoning. Models and algorithms from disciplines such as decision sciences, mathematical programming, operations research, statistics, simulation, and logic modelling, support scenario planning and choice among alternative courses of actions. GMSS are proven to be especially valuable where the amount of available data is too much, the problem is too complex, or precision is highly important.

Building a GMSS requires expertise in decision analysis, programming, and user interface design. A GMSS also requires connectivity to other enterprise applications in real time as well as the internet. Using the mode of assistance, the DSS component of a GMSS may be classified into three different categories: data-driven, model-driven, and knowledge-driven DSS. Data-driven DSS emphasizes accessing and manipulating internal firm data or external and real-time databases with historical data. Model-driven DSS focuses on design and development of financial, operational, statistical, optimization, or simulation models. These systems typically use data and models provided by users to analyse problems that are not data intensive. Knowledge-driven DSS provides specialized problem solving expertise by using facts, rules, or procedures stored in a knowledge base.

DSS generator software embedded in GMSS provides facilities for evaluating alternatives and trade-offs in uncertain, dynamic, and multi-criteria problems. DSS generators are either data-driven or decision-driven. Interactive database query user interface is the most commonly used data-driven DSS. Traditional spreadsheets, natural language programming, and influence diagramming, are among the well-known and commonly used model-driven DSS generators offering textual and/or visual language. Expert system shells that allow construction of a knowledge base and interaction with this knowledge base through use of an inference engine are the most common form of knowledge-driven DSS. Using DSS generators, managers and end-users that are familiar with the problem domain and the relevant modeling paradigm may develop a DSS application quickly and without technical help.

The global organization in the knowledge age

A global organization is defined as any firm that is driven to design, engineer, manufacture, purchase, assemble market, distribute, and/or

service its products or services internationally to achieve competitive marketplace performance.[2] Furthermore, a global organization is viewed as having significant operations and market interests beyond the geographical boundaries of their home countries.[3] Global organizations operate within the manufacturing sector as well as the service sector; the service sector now constituting the largest economic sector in post-industrial societies.

Manufacturing firms operating in global markets today purchase raw materials in one location, ship them elsewhere for production, then, sell their finished products worldwide. Most strive to build local presence, while at the same time, achieve economies of scale. Service organizations operating in global markets today have central customer information depositories in one location and coordinate flow of customer information to/from business units worldwide. Most strive to maintain diverse information requirements at the business level, the management level closest to the customer, while at the same time, create policy and future strategic business plans at the corporate level, the level responsible for the strategy of the entire firm.

Decision-making in these settings is challenging, often crossing boundaries between global and local management levels, therefore, striking the right balance between global and local authority is crucial. Decision-making within these global firms occurs both at the business unit level, as well as the centre; therefore, involving the right people at the right level of the organization is critical for good decision-making. Decisions within these global firms cut across functions, therefore, cross-functional collaboration, that is, fluid decision-making across function teams, is essential for identifying the most attractive and viable business plans. In addition, these global firms are frequently involved in strategic arrangements, namely, outsourcing, joint ventures, alliances, and franchising. Decision-making between separate organizations on different continents requires clear authority and ownership of decision-making among the internal management and their external partners.

As challenging as this decision-making environment is, global organizations that are decision-driven organizations reap benefits; making good decisions and making them happen quickly are the hallmarks of high-performing organizations. According to a study of global firms, the most effective organizations outscore competitors on major strategic decisions – which markets to enter or exit, which businesses to buy or sell, where to allocate capital and talent, how to drive

product innovation, how to position brands and how to manage channel partners.[4]

Decision-making in the global organization

Decision-making is the process of selecting one course of action from among several alternatives. While most decisions are connected with problem-solving, many are not. That said, however, most managerial activities involve components of the decision-making process. The decision-making activity involves gathering and evaluating information about a situation, identifying a need for a decision, defining alternative courses of action, choosing the best, the most appropriate or the optimum action, and then applying the choice in the situation.

Decision models are used in the decision-making process to help decision makers decompose and structure problems. Choice of decision model is dependent on the nature and complexity of the decision and often reflects the management activities within the hierarchy of an organization. Managers at different levels of the organization perform different kinds of activities but one activity typically dominates within each: top managers involve themselves in strategic planning; middle managers exercise management control, and first line managers are involved in operational control. The organizational decisions at different levels are depicted in Figure 18.3.

Global organizations depend on the continuous and seamless flow of information in order to make decisions and perform activities in the new global economy. Global firms use the virtual enterprise strategy to manage suppliers, business partners, employees and contract workers.[5] In order to help meet their organizations' business objectives, global managers rely on information systems and tools. Generally speaking, management support systems are used to support decision-making processes at the mid-level and/or senior level of management; operations support systems are used by managers to support their operations and business processes.

Marginal differences in speed, accuracy, and comprehensive nature of information delivered for decision-making may make the difference in gaining and sustaining competitive advantage. An organization's competence in timely decision support capability has been given recognition by the total quality movement such that 'the ability to access and act on timely, reliable business data is requisite to the achievement of quantitative continual improvement in the delivery of products and service'.[6]
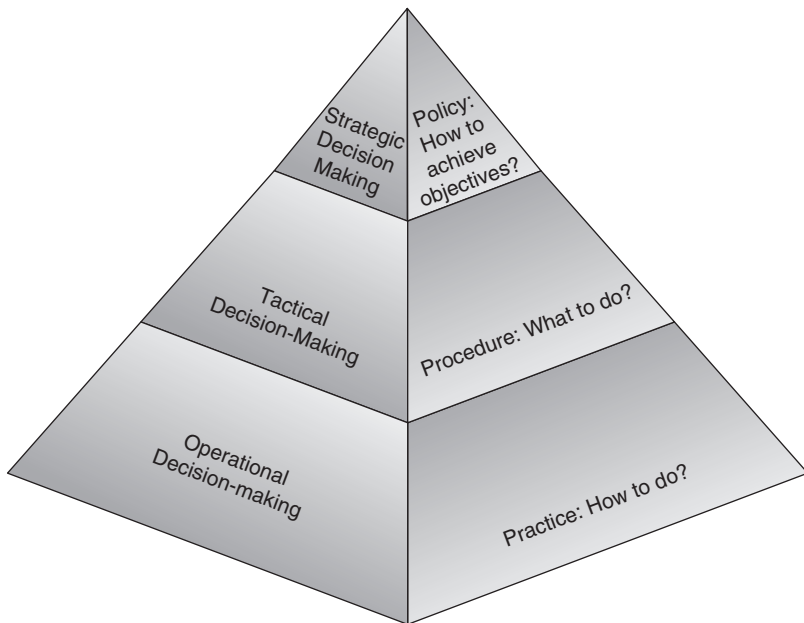
Figure 18.3   Organizational decision-making

An integrated global management support system for the future

As organizations enter the age of the global village where spatial and temporal boundaries are shrinking rapidly, GMSS continue to emerge as a key element in global managerial decision-making and as an essential weapon against global competitors.[7] Stand-alone DSS are no longer effective in coping with problems that involve multinational issues such as multiple currency management, multinational tax management, and global consolidated reporting. It is essential that GMSS integrate DSS with TPS, and KBS.

GMSS must support an integrated global decision-making framework. The framework for integrated global decision-making should link and align daily tactical activities to global organization-wide strategic outcomes. The framework for integrated global decision-making should allow for fact-based and risk adjusted decisions, mindful of geospatial impacts. The framework for integrated global decision-making should enable measurement of horizontal as well as vertical performance across

the entire global enterprise. By aligning this process with the value chain, performance metrics may be developed and monitored for compliance; gaps in performance may be identified; and alternative solutions may be analysed for their impact on the entire global organization.[8]

GMSS must support system internalities and externalities. Integrated global decision-making is driven not just by customer demand but also by laws, executive orders, regulations, directives and mandates that govern organizational operations and logistics.[9] Custom specific issues must be taken into account, including the technological, social/cultural, political/legal and economic environments.

GMSS must support emerging technologies. GMSS need to support the needs of the mobile manager operating in the borderless 24/7 economy; the rapid increase in the application of emerging technologies, such as, internet, intranet, e-commerce, m-commerce, voice over internet protocol, and wireless, has influenced manager's decision-making methodologies.[10]

And GMSS must support an IT-savvy mindset. Research is increasingly demonstrating that IT materially improves business performance.[11] High IT savvy is linked to performance measures such as costs, profits, innovation and market capitalization. Characteristics of IT savvy include IT for communication, that is, high use of electronic channels such as email, intranets and wireless devices for internal and external communications and work practices; digital transactions, more specifically, a high degree of digitalization of the firm's repetitive transactions, particularly sales, customer interaction and purchasing; use of internet architectures for key processes such as sales force management, employee performance measurement training and post-sales customer support; firm-wide IT skills with high capability of all employees to use IT effectively; and business management involvement, that is, strong senior management commitment and championing of IT initiatives.[12] Characteristics of firm-wide IT skills and business management involvement point to a need for IT to be fused with the business; seemingly, this would enhance overall decision-making within the organization. Within the global enterprise, the information system organization must understand the impact organizational strategy has in the IT infrastructure. Furthermore, IT architecture must be created to best support a horizontal business strategy.[13]

Supporting global business activities is a most important and extremely complex task. It is essential to develop a systems oriented, value aligned, integrated GMSS. GMSS must integrate not only TPS, DSS, and KBS, it must also integrate emerging technologies. A new business-focused
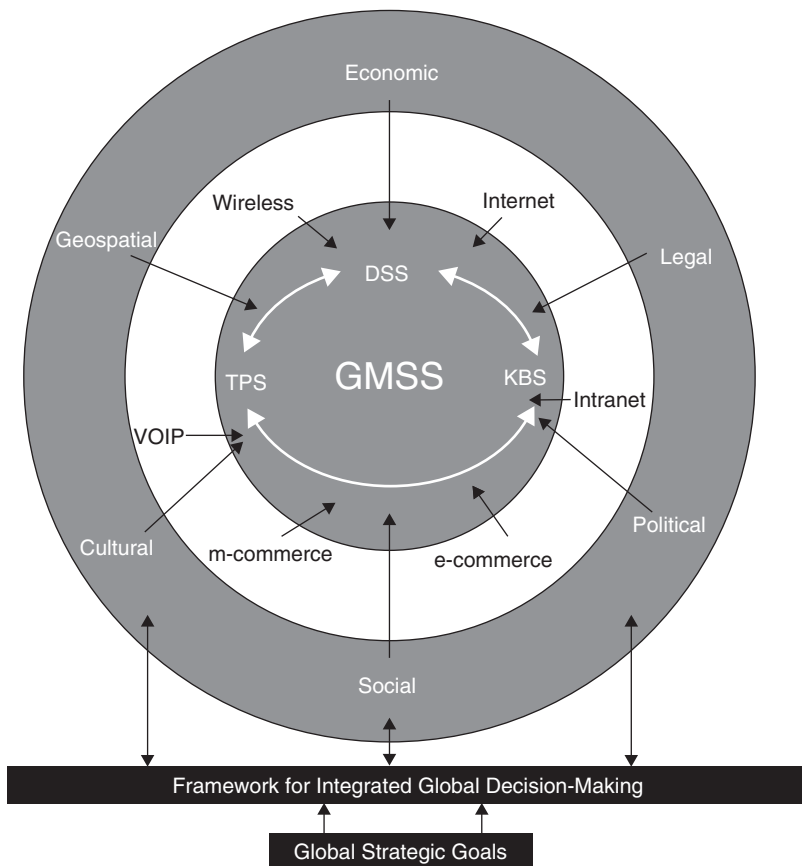
Figure 18.4   Futurescope 2020

global organizational model is necessary in which global business/IT savvy managers assume responsibility to design, build and support the development of GMSS that support a framework for integrated global decision-making. Figure 18.4 presents a schematic of the Integrated Global Management Support System for the future.

Implications for management

The global managers of the world must be prepared to efficiently and effectively manage processes in a global business environment.[14] They are required to make business decisions, global and cross-functional in

nature, using sophisticated integrated computer-based information support systems. Global managers are more mobile; they require telecommunications and technology solutions to allow them to conduct business while on the move.

Management development that blends the quantitative business operations and decision-making techniques learned in OM, with the application of IS technology for solving business problems would benefit managers. An integrated OM/IS approach would enhance their understanding of problem-solving and decision-making in the integrated global environment as they prepare to enter the future of business.

Conclusion

Competitive advantage may be won or lost by marginal differences in the speed, accuracy, and comprehensive nature of information being delivered to decision makers. An organization's competence in timely decision support capability is pivotal in the knowledge age. The fact that IT materially improves business performance is not in dispute. Seamless IT infusion with business would enhance overall decision-making within the organization. The organization within the global enterprise must understand the impact organizational strategy has on the IT infrastructure. Furthermore, it must determine and create IT architecture to best support its needs for the future. DSS clearly enhance a manager's ability to make decisions, but lack optimal benefit as stand-alone systems. As the global environment within which organizations operate becomes more complex, leaders will most certainly recognize the need for an infrastructure to support integrated global decision-making. GMSS, as integrated information/emerging technology systems, designed by IT Savvy managers, can satisfy the infrastructure needs of the global organization in the knowledge age.

Notes

1. Cuffe, S., 2005, 'Emerging Management Support System Models for Global Managers in the New Economy', *Journal of Knowledge Management Practice*, Volume 6.
2. Passino, J. H. and Severance, D. C., 1991, 'Harnassing the Potential of Information Technology for Support of the New Global Organization', *Human Resource Management*, 29, (1), pp. 69–76.
3. Hout *et al*., 1982; Anthony *et al*., 1984; Vernon and Wells, 1986; Neo, 1991, Cited in Bryd, T.A., Sankar, C., McCreary, J. D., 1997, 'The Risks Associated With Planning and Implementing Global Information Technology Systems', in P.C Deans and K.R. Karwan, *Global Information Systems and*

Technology: Focus on the Organization and Its Functional Areas, Harrisburg, PA: Idea Group Publishing.

4. P. Rogers and M. Blenko, 2006, 'Who Has the D? How Clear Decision Roles Enhance Organizational Performance', *Harvard Business Review*, 84 (1), pp. 52–61.

5. Cuffe, 2005, Management Support System Models, op. cit.

6. Sloan, R. and Green, H., 1993, 'An Information Architecture for the Global Manufacturing Enterprise', *Information Management: Strategies, Systems and Technologies*, 5, (5).

7. Eom, S. B., 2001, 'Decision Support Systems', in Warner, M., *International Encyclopedia of Business and Management*, 2nd edition, London, England: International Thomson Business Publishing Co.

8. Hammond, D., 2006, 'The Framework for Integrated Decision-Making', Publication of the Government/Industry Forum, National Academies' Federal Facilities Council, Washington, DC: National Academy of Sciences.

9. Idem.

10. Cuffe, 2005, Management Support System Models, op. cit.

11. Sloan and Green, 1993, Information Architecture, op. cit.

12. Weill, P. and Aral, S., 2006, 'Generating Premium Returns On Your IT Investments', *MIT Sloan Management Review*, 47, (2), pp. 39–48.

13. Sloan and Green, 1993, *Information Architecture*, op. cit.

14. Silva, D. and McFadden, K., 2005, 'Combining Operations Management and IS Curricula: Assessing Alumni Perspectives for the Workplace', *Decision Sciences Journal of Innovative Education*, 3, (2), pp. 307–21.