Part 6: Implementation, Integration and Impacts

Chapter 20: Implementing and Integrating MSS

Chapter 21: Organizational and Societal Impacts of MSS

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Chapter 20: Implementing and Integrating MSS

- **Building MSS**
- **First phase: decision making support and problem solving**
  - **Implementation**
  - **Integration of MSS Technologies**

20.1 Opening Vignette: INCA Expert Systems for The *SWIFT* Network

- Society for Worldwide Interbank Financial Telecommunication (S.W.I.F.T.) Network
- International message-processing and message transmission services between financial institutions
- Want to automate the day to day control of the network
- Replace teams of operators working switches
- Two Control Centers: USA and Holland: 8

- **Real-time decision making system necessary for network control**
- ***The system could not fail***
- **Intelligent Network Controller Assistant (INCA) performs**
- **Filters incoming events and diagnoses problems**
- **Displays problems requiring attention**
- **Core business application**
- **Working prototypes not used**

- **Special software development methodology developed and followed for tight quality control**
- **Allow the flexibility required for AI development**
- **Incremental extraction of knowledge from experts not possible**
- **Hardware and software: standard workstations**
- **Future users and experts were involved in every implementation phase**
- **User training plans created and implemented simultaneously with system development**

- **Object-oriented paradigm**
- **Events trigger rules to fire**
- **Temporal information was also considered**
- **INCA dynamically updates its model of the S.W.I.F.T. network on line.**
- **INCA developed by a core team of five; three from corporate research, two from operations**
- **Initially also two knowledge engineers from TI**

INCA Implementation Timeline

- Early 1989: Brief prototyping exercise
- April 1989: INCA started
- October 1989: First deployment in one control center
- Processing functions introduced in modular phases to minimize risks
- February 1990: INCA fully operational in the Holland Center
- May 1990: Fully operational in the USA Center
- Summer 1990: Maintenance gradually turned over to internal system support group
- INCA is working well and well accepted

Criteria for Successful Implementation

- INCA should achieve staff savings
- INCA should be accepted by the client group for
  - Its functions
  - Its quality
- Improve response times
- Limit network downtime
- Results
- INCA can automatically handle 97 % of all events
- Now only two INCA teams; each one can replace the original eight teams
- Estimated reduction in staff: 50

- **The INCA development team: *Victim of Success!***
- **Managers want additional features and functions**

20.2 Implementation: An Overview

INCA - Major Points

About Systems Implementation

- Situation where standard methods do *not* work
- Custom implementation methods must be designed, tested and implemented
- Users must be involved in every phase of the development
- Management support is crucial (though not mentioned)
- Experts must be cooperative
- Criteria for success were clearly defined
- Large-scale, real-time ES can be developed on schedule and be very reliable

Introduction

- **MSS systems implementation is not always successful**
- **Expert systems fail often**
- **Implementation is an ongoing process of preparing an organization for the new system**
- **And introducing the system to assure success.**

- **MSS implementation is complex**
- **MSS are linked to tasks that may significantly change the manner in which organizations operate**
- **But, many implementation factors are common to any IS**

What Is Implementation?

- There is "nothing more difficult to carry out, nor more doubtful of success, nor more dangerous to handle, than to initiate a new order of things" (Machiavelli)
- The *introduction of change*
- Implementation is a long, involved process with vague boundaries
- *Implementation* can be defined as getting a newly developed or significantly changed, system to be used by those for whom it was intended

MSS Implementation

Ongoing process during the Entire Development

- **Original suggestion**
- **Feasibility study**
- **Systems analysis and design**
- **Programming**
- **Training**
- **Conversion**
- **Installation**

- **For MSS: Iterative Nature of Development Complicates Matters**

- **Institutionalization: MSS implementation means commitment to routine and frequent system use**
- **Ad hoc decisions: MSS implementation means the one-time use of the system**
- **Can have *Partial Implementation***

Measuring Implementation Success Indicators

1. Ratio of actual project execution time to the estimated time

2. Ratio of actual project development cost to budgeted cost

3. Managerial attitudes toward the system

4. How well managers' information needs are satisfied

5. Impact of the project on the computer operations of the firm

Other MSS Success Measures

- System Use
- User satisfaction
- Favorable attitudes
- Degree to which system accomplishes its original objectives
- Payoff to the organization
- Benefits to costs ratios
- Degree of institutionalization of MSS in the organization

Additional Measures of ES Success

- Degree to which the system agrees with a human expert
- Adequacy of the system's explanations
- Percentage of cases submitted to the system for which advice was not given
- Improvement of the ES on the learning curve (speed to maturity)

Guimaraes et al. [1992] and Sprague and Watson [1996])

DSS In Focus 20.1: The Success of DSS

Meador et al. [1984]: Rate your agreement with the success of your DSS

1. The DSS fits in well with our planning methods
2. It fits in well with our reporting methods
3. It fits in well with our way of thinking about problems
4. It has improved our way of thinking about problems
5. It fits in well with the " politics" of how decisions are made around here
6. Decisions reached with the aid of the DSS are usually implemented
7. The DSS has resulted in substantial time savings
8. It has been cost-effective
9. It has been valuable relative to its cost
10. It will continue to be useful to our organization for a number of years
11. It has so far been a success

Contributing Factors to DSS Success

- User involvement
- User training
- Top management support
- Information source
- Level of managerial activity being supported
- Characteristics of the tasks involved (structure, uncertainty, difficulty, interdependence)

MSS Implementation Failures

- Usually a closely held secret in many organizations
- Expected synergy of human and machine not developed
- Managers unwilling to use computers to solve problems
- Not much formal data on MSS failures
- Many informal reports on unsuccessful implementation

20.3 The Major Issues of Implementation
Models of Implementation

- **Many factors can determine the degree of success of any IS**
- ***Factor* or *success factor* - Important**
  - **Generic**
  - **Specific**
- **Determinants of successful implementation (next)**

Success Factors of Implementation

(Figure 20.1)

- **Technical Factors**
- **Behavioral Factors**
- **Change Management**
- **Process and Structure**
- **User Involvement**
- **Ethics**
- **Organizational Support**
- **External Environment**
- **Project Related Factors**

Technical Factors

- **Relate to the mechanics of the implementation procedure (Table 20.1)**
- **Two Categories**
  - **Technical Constraints**
  - **Technical Problems**

TABLE 20.1 Technical Implementation Issues

Level of Complexity (must be low)
System Response Time and Reliability (must be high)
Inadequate Functions (functions are needed)
Lack of equipment (hardware and software can help)
Lack of standardization (standards help integration and dissemination)
Problems with the networks (e.g., connectivity); distributed MSS are on the rise
Mismatch of hardware/software
Low level of technical capacity of the project team

Behavioral Factors

- **CBIS Implementation affected by the way people perceive systems and by how people behave**
- ***Resistance to Change***

TABLE 20.2 Behavioral Factors

Factors	Description
Decision Styles	Symbolic processing of AI is heuristic, DSS and ANN is analytic
Need for Explanation	ES provides explanation, ANN does not. DSS may provide partial explanation. Explanation can reduce resistance to change
Organizational Climate	Some organizations lead and support innovations and new technologies while others wait and lag with changes
Organizational Expectations	Overexpectation can result in disappointments and termination of innovation. Overexpectation was observed in most early intelligent systems
Resistance to Change	Can be strong in MSS, since the impacts may be significant. Many can resist (see AIS In Action 20.2, Alter [1980] and Guimaraes et al. [1992])

AIS In Action 20.2: The Resistors to Expert Systems

- Managers--some fear their jobs will be automated or become less important
- Experts--some fear undue exposure or a reduction in importance, others are afraid of losing their jobs
- Nonexperts--some fear lack of recognition and less opportunity to prove themselves. Others are afraid of becoming unimportant
- CIO--see consultants and vendors and fear decline in his/her empire
- The generally insecure--some in every organization are routinely insecure and afraid of any change
- Technologists--some may fear that if the technology is outside their IS department, they will lose power and control
- Users--some resist computerization in general and experience problems with the human-machine interface
- Training staff/management--some may fear that self-instruction by interacting with the expert system will diminish their role
- Unions--see as an opportunity to gain membership

(*Source*: Based on Beerel [1993])

Process Factors

- **Top Management Support (One of *the* most important)**
  - **Need for *continuous* financial support for maintenance**
  - **Few studies on methods to increase top management MSS support**
- **Management and User Commitment**
- **Institutionalization**
- **Length of Time Users Have Been Using Computers and MSS**

User Involvement

- **Participation in the system development process by users or representatives of the user group**
- **Determining when user involvement should occur and how much is appropriate need more research**
- **In user-developed systems, the user obviously is very much involved**
- **With teams, involvement becomes fairly complex**

- **DSS Development: Heavy user involvement *throughout* the developmental process with a much direct management participation**

- ***Joint Application Development* (JAD) procedure strongly recommended**

TABLE 20.3 Management Involvement in DSS Development. Percentage of Companies with Management Involvement at Each Management Level and Development Stage

Phase in Life Cycle	Management Level			
	Lower	Middle	Top	Any Level
Conceptualization	0%	61%	61%	100%
Information Requirements	0	78	61	100
System Building	11	72	6	78
System Testing	11	72	6	83
System Demonstration	11	78	28	89
System Acceptance	0	72	67	100

Source: Adapted from Sprague and Watson [1996].

Organizational Factors

- Competence (Skills) and Organization of the MSS Team
- Responsibility for DSS Development and Implementation
- Adequacy of Resources
- Relationship with the Information Systems Department
- Organizational Politics
- Other Organizational Factors
  - Role of the system advocate (sponsor) initiator
  - Compatibility of the system with organizational and personal goals of the participants

Values and Ethics

Management is Responsible

- Project Goals
- Implementation Process
- Possible Impact on Other Systems

External Environment

Factors Outside the Immediate Area of the Development Team, Including

- Legal Factors
- Social Factors
- Economic Factors
- Political Factors (e.g., Government Regulations)
- Other Factors (Positive or Negative)

Up to Now - Implementation Climate Issues

Project-related Factors

- **Evaluate each project on its own merits**
  - **Relative importance to the organization**
  - **Its members**
- **Cost-benefit criteria**
- **Other Project Evaluation Dimensions**

Other Project Evaluation Dimensions

- Important or major problem needing resolution
- Real opportunity needing evaluation
- Urgency of solving the problem
- High-profit contribution of the problem area
- Contribution of the problem area to growth
- Substantial resources tied to the problem area
- Demonstrable payoff if problem is solved

Expectations from a Specific System

- **Users have expectations as to how a system will**
  - **Contribute to Their Performance**
  - **Rewards Can Affect Which System is Used**
- **Over-expectations**
  - **Dangerous**
  - **Observed in AI Technologies**

Cost-benefit Analysis

- View application as an alternative investment
-
- Application should show
  - a payoff
  - an advantage over other investment alternatives
- Since mid-1980s, IS justification pressures have increased
- Effective implementation depends on effective justification

Other Items

- **Project Selection**
  - **(Critical for ES)**
- **Project Management**
- **Availability of Financing and Other Resources**
- **Timing and Priority**

20.4 Implementation Strategies

- Many implementation strategies
- Many are generic
- Can be used as guidelines in implementing
  - DSS
  - ES

Implementation Strategies for DSS

Major Categories

- Divide the project into manageable pieces
- Keep the solution simple
- Develop a satisfactory support base
- Meet user needs and institutionalize the system

(Table 20.4)

TABLE 20.4 DSS Implementation Strategies

plementation Strategy	Typical Situation or Purpose	Pitfalls Encountered
ivide project into anageable pieces.	Minimize the risk of developing a large, failing system.	
se prototypes.	Success depends upon relatively novel concepts. Test the concepts before commitment to the complete system.	Reactions to the prototype usually differ from those to a final, deployed system.
volutionary approach.	Attempts to reduce feedback loops between implementer and clients and between intentions and products.	Users must live with continuous change.
evelop a series tools.	Meets ad hoc analysis needs with databases and small models to be created, modified and discarded.	Applicability is limited. Maintenance costs for infrequently used data.
eep the solution simple.	Encourage use so as not to frighten users.	Usually beneficial, but can lead to misrepresentation, misunderstanding and misuse.
simple.	For naturally simple systems, not an issue. For complex systems or situations, if possible, select simple approaches.	Some business problems are just not simple. Requiring simple solutions may lead to ineffective systems.
ide complexity ncapsulation).	The system is viewed in its simplest fashion, as a "black box" that answers questions using procedures hidden from the user.	Black boxes can result in inappropriate system or results use.
void change.	Automate existing processes, if possible, instead of developing new ones. Stability.	New systems may have minimal impact. Not a good policy when desiring process changes.
evelop a cooperative pport base.	One or more components of a user-management support base are not present.	Danger that one support-gaining strategy will be applied without adequate attention to others.
et user participation.	When the system effort is not initiated by users and/or the usage	Multiple users imply multiple objectives to be balanced. Not

Expert System Implementation

Especially important in ES implementation

- Quality of the system
- Cooperation of the expert(s)
- Conditions justifying the need for a particular ES

Quality of the Expert System

1. The ES should be developed to fulfill a recognized need
2. The ES should be easy to use (even by a novice)
3. The ES should increase the expertise of the user
4. The ES should have exploration capabilities
5. The program should respond to simple questions
6. The system should be capable of learning new knowledge
7. The knowledge should be easily modified

Necessary, but not sufficient features for success

Some Questions About Experts' Cooperation

- **Should the experts be compensated for their contribution?**
- **How can one tell if the experts are truthful?**
- **How can the experts be assured that they will not lose their jobs, or that their jobs will not be de-emphasized?**
- **Are the experts concerned about other people whose jobs may suffer, and if so, what can management do?**

Use incentives to influence the experts to ensure cooperation

Some Conditions That Justify an ES

- An expert is not always available or is expensive
- Decisions must be made under pressure, and/or missing even a single factor could be disastrous
- Rapid employee turnover resulting in a constant need to train new people (costly and time-consuming)
- Huge amount of data to be sifted through
- Shortage of experts is holding back development and profitability
- Expertise is needed to augment the knowledge of junior personnel
- Too many factors--or possible solutions--for a human to juggle

Continue

More Conditions

- Problem requires a knowledge-based approach and cannot be handled by conventional computing
- Consistency and reliability, not creativity, are paramount
- Factors are constantly changing
- Specialized expertise must be made available to people in different fields
- Commitment on the part of management
- User involvement
- Characteristics of the knowledge engineer

20.5 What Is Systems Integration and Why Integrate?

- Not separate hardware, software and communications for each independent system
- At development tools level or application system level

- Two General Types of Integration
  - Functional
  - Physical

Integration Types

- **Functional Integration**
  - **(Our primary focus)**
  - **Different support functions are provided as a single system**
- **Physical Integration**
  - **Packaging hardware, software and communication features required together for functional integration**

Why Integrate?

Two Major Objectives for MSS Software Integration

- **Enhancements of Basic Tools**
- **Increasing the Applications' Capabilities**

Integrating DSS and ES

- **Mutual Benefits Each Technology Provides (Table 20.5)**
- **Integrating DSS, ES and EIS (health care industry)**
- **Integrating medical expert systems, patient databases and user interfaces using conventional tools: PACE, a comprehensive expert consulting system for nursing**

TABLE 20.5 Summary of Integrating Expert Systems and DSS

	ES Contribution	DSS Contribution
Database and Database Management Systems	• Improves construction, operation and maintenance of DBMS • Improves accessibility to large databases • Improves DBMS capabilities (DBMS) • Permits symbolic representation of data • Advises on data warehouse	• A database is provided to the ES • Provides numeric representation of data
Models and Model Base Management Systems	• Improves model management • Helps in selecting models • Provides judgmental elements to models • Improves sensitivity analysis • Generates alternative solutions • Provides heuristics • Simplifies building simulation models • Makes the problem structure incrementally modifiable • Speeds up trial-and-error simulation	• Provides initial problem structure • Provides standard models computations • Provides facts (data) to models • Stores specialized models constructed by experts in the model base
Interface	• Enables friendlier interface • Provides explanations • Provides terms familiar to user • Acts as a tutor • Provides interactive, dynamic, visual problem-solving capability	• Provides presentations to match individual cognitive styles
System	• Provides intelligent advice	• Provides effectiveness in data

Two General Types of Integration

- **Different Systems (e.g., ES and DSS)**
- **Same Type Systems (e.g., Multiple ES)**

20.6 Models of ES and DSS Integration

- Names ranging from *expert support systems* to *intelligent DSS*

Models

- ES Attached to DSS components
- ES as a Separate DSS Component
- ES Generating Alternative Solutions for DSS
- Unified Approach

Expert Systems Attached to DSS Components

Five ES (Figure 20.2)

1: Intelligent database component

2: Intelligent agent for the model base and its management

3: System for improving the user interface

4: Consultant to DSS builders

5: Consultant to users

ES as a Separate DSS Component

- **Architecture for ES and DSS integration (Figure 20.3)**
- **ES is between the data and the models to integrate them**
- **Integration is Tight**
- **But can be over Communications Channels like the Internet**

3 Possible Integration Configurations

- **ES Output as Input to a DSS**
- **DSS Output as Input to ES**
- **Feedback (both ways)**

(Figure 20.4)

Sharing in the Decision-making Process

- **ES can complement DSS in the decision-making process (8-step process)**

1. **Specification of objectives, parameters, probabilities**
2. **Retrieval and management of data**
3. **Generation of decision alternatives**
4. **Inference of consequences of decision alternatives**
5. **Assimilation of verbal, numerical and graphical information**
6. **Evaluation of sets of consequences**
7. **Explanation and implementation of decisions**
8. **Strategy formulation**

Continue

- **1-7: Typical DSS functions**
- **8: Requires judgment and creativity - can be done by ES**
- **ES supplements the DSS with associative memory with business knowledge and inferential rules.**

20.7 Integrating EIS, DSS, and ES, and Global Integration

- **EIS and DSS**
  - **EIS is commonly used as a data source for PC-based modeling**
- **How?**
  - **EIS-generated information as DSS input**
  - **DSS feedback to the EIS and possible interpretation (AIS In Action 20.3) and ES explanation capability**

Global Integration

- **May include several MSS technologies**
- **Comprehensive system conceptual architecture (Figure 20.5)**
  - **Inputs**
  - **Processing**
  - **Outputs**

Outputs. User Can Generate

1. **Visually attractive tabular graphic status reports that describe the decision environment, track meaningful trends and display important patterns**

2. **Uncontrollable event and policy simulation forecasts**

3. **Recommended decision actions and policies**

- **System graphically depicts the reasoning explanations and supporting knowledge that leads to suggested actions**

Global Integrated System Example

- **To connect the MSS to other organizations - EDI and Internet (Figure 20.6)**
- **Corporate MSS includes**
  - **DSS and ES**
  - **Internet-based videoconferencing system for group-work**
  - **EDI for transaction processing**

20.8 Intelligent Modeling and Model Management

Add intelligence to Modeling and Management

- Tasks require considerable expertise
- Potential benefits could be substantial
- Integration implementation is difficult and slow

Issues in Model Management

- **Problem Diagnosis and Model Selection**
- **Model Construction (Formulation)**
- **Models Use (Analysis)**
- **Interpretation of Models' Output**

Quantitative Models

- **Proposed architecture for quantitative intelligent model management (Figure 20.7)**
- **Human experts often use quantitative models to support their experience and expertise**
- **Many models are used by experts in almost all aspects of engineering**

ES Contributions in Quantitative Models and Model Management

Demonstrate by examining the work of a consultant

1. Discussing the nature of the problem with the client
2. Identifying and classifying the problem
3. Constructing a mathematical model of the problem
4. Solving the model
5. Conducting sensitivity analyses with the model
6. Recommending a specific solution
7. Assisting in implementing the solution

- **System involves a decision maker (client), a consultant and a computer.**
- **If we can codify the knowledge of the consultant in an ES, we can build an intelligent computer-based information system capable of the same process**
- **But - Hard to do**
- **Some ES research is moving in this direction**
- **ES can be used as an intelligent interface between the user and quantitative models**
- **There are several commercial systems to assist with statistical analysis**

20.9 Examples of Integrated Systems

- Manufacturing
- Marketing
- Engineering
- Software Engineering
- Financial Services
- Retailing
- Commodities Trading
- Property-casualty Insurance Industry Decision Making

Manufacturing

- **Integrated Manufacturing System**
  - **Logistics Management System (LMS) - IBM**
  - **Combines expert systems, simulation and decision support systems**
  - **And computer-aided manufacturing and distributed data processing subsystems**
  - **Provides plant manufacturing management a tool to assist in resolving crises and help in planning**
  - **Similar system at IBM by financial analysts to simulate long-range financial planning**

- **Combination of several, complex expert systems (implemented as intelligent agents) with a scheduling system and a simulation-based DSS for rescheduling production lines when problems occur**

- **Embedded Intelligent Systems**

  - **Data mining systems**

  - **Others**

- **DSS/Decision Simulation (DSIM - IBM). Integration provides:**
  - **Ease of communication**
  - **Assistance in finding appropriate model, computational algorithm or data set**
  - **Solution to a problem where the computational algorithm(s) alone is not sufficient to solve the problem, a computational algorithm is not appropriate or applicable and/or the AI creates the computational algorithm**
- **Intelligent Computer Integrated Manufacturing**
- **Error recovery in an automated factory**
- **MSS in CAD/CAM Systems**
  - **Comprehensive CIM System (Table 20.6)**

TABLE 20.6 Role of the MSS in Computer-integrated Manufacturing--the Factory of the Future

Function Aided by Computers	Description	Supported by				
		ANN	ES	NLP	Robots	DSS
Assembly and packaging	Uses robots to put together parts fabricated on site and purchased from outside. Packages ready for shipment.		X	X	X	X
Design (CAD)	Creates the design for a product.		X			X
Engineering	Designs the tools, molds and other facilities needed for manufacturing.		X			
Factory management	Runs the entire production process, coordinates incoming orders, requests components and material, plans and schedules, overseas cost control, arranges deliveries		X	X		X
Headquarters	Decides what products to make, when and how much (based on market research, available resources, and strategic planning)	X	X	X		X
Logistics and storage	Purchases and distributes materials, handles inventory control, removes materials, manages supplies. Shuttles incoming materials and parts, work in process and final products		X		X	X
Maintenance	Monitors equipment and processes, makes adjustments when needed,	X	X	X	X	

Marketing

- **Promoter**
- **TeleStream**

Engineering

- **STRUDL**

Software Engineering

- **CREATOR2: CASE Tools with ES**
- **CREATOR3**

Financial Services

- Integrated system to match services with customers' needs
- Credit evaluation
- Strategic planning
- FINEXPERT
- American Express
- Inference Corp. System (Figure 20.8)

Retailing

- **Buyer's Workbench**
- **Deloitte and Touche for Associated Grocers**

(Figure 20.9)

Commodities Trading

- **Intelligent Commodities Trading System (ICTS)**

  (Figure 20.10)

Property-casualty Insurance Industry

Decision Making

- Decision making for insurance industry based on forecasting
- Major decisions involve
  - Determining what products to offer
  - Pricing of products
  - Determining territories to operate
  - Deciding how to invest premium money collected
- Integrated ES-ANN system combined with a DSS (Figure 20.11)

Flow Chart Shows the Roles of Each Major Component

1. DSS provides statistical analysis and graphical display

2. ANN analyzes historical data and recognizes patterns

3. Results generated by the DSS and by the ANN to ES for interpretation and recommendation

Recommendations are tested by the DSS using "what-if"

20.10 Problems and Issues in Integration

- Need for Integration
- Justification and Cost-benefit Analysis
- Architecture of Integration
- People Problems
- Finding Appropriate Builders

Continue

- **Attitudes of Employees of the IS Department**
  - **Part of the problem is cultural**
- **Development Process**
- **Organizational Impacts**
- **Data Structure Issues**
- **Data Issues**
- **Connectivity**

Summary

- **Many MSS projects fail or are not completed**
- **Many factors determine successful implementation**
- **Implementation is an ongoing process**
- **Implementation means *introducing change***
- **Partial success of implementation is possible; usually measured by several criteria**

- **Technical success is related to system's complexity, reliability and responsiveness; hardware, network and software compatibilities; and technical skills of builders**
- **Organizational climate and politics can be detrimental to success**
- **Many dimensions to change and to its resistance; overcoming resistance is complex**
- **Importance of user involvement varies depending on the MSS technology**

- **Several organizational factors are important to successful implementation**
- **Lack of adequate resources means failure**
- **Medium and large MSS projects must go through a rigorous cost-benefit analysis. Many benefits are intangible**
- **Functionality of conventional CBIS may be increased when MSS technology is integrated with them**

- **Functional integration differs from the physical integration**
- **Intelligent databases are a major integration area of databases (and DBMS) with ES and NLP**
- **ES can simplify databases accessibility**
- **Major area of integration: ES to interpret results of data generated by models**
- **ES can enhance knowledge management and model management**

- **ES are being successfully integrated with DSS**
- **There are several conceptual models of integration of ES and DSS**
- **MSS technologies are being integrated with many CBIS**
- **There are many problems with integrating AI technology: technical, behavioral and managerial factors**

Questions for the Opening Vignette

1. Why was INCA not allowed to fail? That is, what were the consequences of failure?
2. Why couldn't rapid prototyping be used as an implementation method?
3. Describe some of the unique aspects of INCA that required a modified development approach.
4. Describe some difficulties in developing a system design methodology while developing a system.
5. Why did the object-oriented approach make sense here? Do you think that INCA used a variant of forward chaining or backward chaining for its inference engine?

Exercise

- **Administer the questionnaire to users of DSS in your class!**
- **Comment on the results**

Group Exercise

3. **Meet and discuss ways in which intelligence could be integrated into your university's advising and registration system. Are there any concrete ways in which it could be accomplished at low cost and relatively fast? Explain.**

CASE APPLICATION 20.1: Urban Traffic Management

Case Questions

1. Why is it necessary to employ a DSS in this case?

2. Why is it necessary to include knowledge bases?

3. Why are there different databases, knowledge bases and model bases?

4. How can GIS be incorporated into such a system?