Chapter 1
Toward an Interdisciplinary Engineering and Management of Complex IT-Intensive Organizational Systems:
A Systems View

Manuel Mora
Universidad Autónoma de Aguascalientes, México

Ovsei Gelman
CCADET, Universidad Nacional Autónoma de México, México

Moti Frank
HIT - Holon Institute of Technology, Israel

David B. Paradice
Florida State University, USA

Francisco Cervantes
Universidad Nacional Autónoma de México

Guisseppi A. Forgionne
University of Maryland, Baltimore County, USA

ABSTRACT

An accelerated scientific, engineering, and industrial progress in information technologies has fostered the deployment of Complex Information Technology (highly dependent) Organizational Systems (CITOS). The benefits have been so strong that CITOS have proliferated in a variety of large and midsized organizations to support various generic intra-organizational processes and inter-organizational activities. But their systems engineering, management, and research complexity have been substantially raised in

the last decade, and the CITOS realization is presenting new technical, organizational, management, and research challenges. In this article, we use a conceptual research method to review the engineering, management, and research complexity issues raised for CITOS, and develop the rationality of the following propositions: **P1***: a plausible response to cope with CITOS is an interdisciplinary engineering and management body of knowledge; and* **P2:** *such a realization is plausible through the incorporation of foundations, principles, methods, tools, and best practices from the systems approach by way of systems engineering and software engineering disciplines. Discussion of first benefits, critical barriers, and effectiveness measures to reach this academic proposal are presented.*

*Businesses no longer merely depend on information systems. In an increasing number of enterprises, the systems are the business. (*R. Hunter & M. Blosch, Gartner Group, 2003)

INTRODUCTION

An accelerated scientific, engineering, and industrial progress in information technologies and its convergence with communications technologies (the ICT concept) has fostered the deployment of Complex Information Technology (highly dependent) Organizational Systems (CITOS) in the last decade. The CITOS concept subsumes the well-known constructs of *mission-critical systems*, *large-scale information systems*, *enterprise information systems*, and *inter-organizational information systems*. Generic instances of CITOS are worldwide credit card systems, brokerage financial systems, military defense systems, large ERPs, governmental tax payment systems, and worldwide e-commerce and B2B supply-chain systems in automotive and publishing industries.

Empirical evidence, such as (a) the raising of the ICT budget (measured as a percentage of sales) to 5%-9% in the 2000s (Prewitt & Cosgrove, 2006); (b) the growing of world ICT trade from 8% in 1995 to 10% in 2001 with a 4% annual growth rate (OECD, 2004); (c) the IT commoditization or democratization phenomenon being more affordable the ICT infrastructure in midsized firms in the 1990s (Carr, 2003); (d) the maturing of the myriad of ICT in the last decade (e.g., mobile computing, wireless networks, Web services, grid computing, and virtualization services); (e) the new ways for performing business-oriented operational, tactical, and strategic organizational duties through ICT (e.g., workflow systems, business process management, and service-oriented management); (f) the several tangible and intangible organizational benefits from intra-organizational processes (as in Porter's value-chain activities) and inter-organizational activities (supplier-customer value chains, B2B, and e-government initiatives) leveraged by CITOS; and (g) the thousands of US dollars lost due to availability, continuity, and capacity failures in ICT services (van Bon, Pieper, & van deer Veen, 2006) because of an hour of system downtime. These factors and others show that CITOS are relevant for business and government organizations (as well as for nonprofit organizations).

Such systems are characterized by having (1) many heterogeneous ICT (client and server hardware, operating systems, middleware, network and telecommunication equipment, and business systems applications) (2) a large variety of specialized human resources for their engineering, management, and operation; (3) a worldwide scope; (4) geographically distributed operational and managerial users; (5) core business processes supported; (6) a huge financial budget for organizational deployment; and (7) a critical interdependence on ICT. Thus, these can be correctly labeled as "complex systems"