Why ERP Systems will Keep Failing

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A ‘user’ experience of ERP

A man got a purchase order form, containing the next text:

**Product name:** guest lecturer LAR 26309, 80 x €55,00
**Quantity:** 1
**Price per unit:** 4400,00 EUR
**Delivery address:** University Wageningen, Building 101, goods receiving DOW
**Mention purchase order number on packing note and invoice.**

The man thought: would this be my promised guest lecturer contract? So he replied:

“Thanks for the order with the above mentioned purchase order number. The requested product ‘guest lecturer LAR 26309’ is ready for delivery. Delivery will take place in parts, without packing note”
Outline

Introduction and problem definition

Introduction to Enterprise Engineering

The PSI-theory

The genotype and phenotype of organisations

The BETA-theory

Conclusions
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What is an Enterprise Information System?

(Wikipedia)
An enterprise information system (EIS) is any kind of information system that improves the functions of an enterprise business processes by integration. This means typically offering high quality of service, dealing with large volumes of data and capable of supporting some large and possibly complex organisation or enterprise.

(My definition)
An enterprise information system (EIS) is an information system that supports the operational activities in an enterprise in an integral way.
What is an ERP system?

(Wikipedia)
Enterprise resource planning (ERP) is business management software—usually a suite of integrated applications—that a company can use to store and manage data from every stage of business, including product planning, cost and development, manufacturing, marketing and sales, inventory management, shipping and payment.

(My definition)
An ERP-system is an enterprise information system that is based on the reference model of enterprise resource planning (originally developed for manufacturing companies).
EISs, notably ERP-systems, are rarely a real success, i.e. they do not meet user expectations

The key problem is not the engineering of the EISs, but the identification of the user expectations

What users expect from an EIS is that it supports them in all of their activities, in all situations

These user needs can not be found out by just making enquiries. This would resemble a medical doctor asking a patient to do the diagnosis!

They can however be found out by basing enquiries on the proper and profound understanding as offered by enterprise engineering

Only then can completeness and relevance be guaranteed
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The discipline of Enterprise Engineering

Enterprise Engineering (EE) is the scientific discipline in which enterprises are considered to be designed systems, which consequently can be re-designed. This is a radically new paradigm!

EE is built on three foundational pillars:

- Enterprise Ontology
- Enterprise Architecture
- Enterprise Governance

94% of inadequate enterprise performance is the inevitable result of how enterprises are designed.

William Edwards Deming
The generic goals of Enterprise Engineering

• **Intellectual manageability**
  – In order to bring about organisational changes, one needs to have insight and overview. This implies a well devised systematic reduction of complexity (*Enterprise Ontology*)

• **Organisational concinnity**
  – For an enterprise to be a coherent and consistent whole, its parts must be arranged in a skillful and harmonious way. This implies well devised design (*Enterprise Architecture*)

• **Social devotion**
  – Enterprise Engineering takes a human centered view on organisations. This implies a well devised distribution of authority and responsibility (*Enterprise Governance*)

The CIAO! Network

Tokyo Institute of Technology

Universidade da Madeira

TU Lisbon

Universiteit Antwerpen

University of St. Gallen

IBM Research Almaden, USA

CTU Prague

Delft University of Technology

Moscow and Nizhniy Novgorod, Russia

Public Research Centre, Luxembourg
The CIAO! Tree

APPLICATIONS

METHODS

THEORIES

philosophical  ontological  technological  ideological
The EE Theory Framework

<table>
<thead>
<tr>
<th>Ideological Theories</th>
<th>Technological Theories</th>
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<tr>
<td><em>selecting the things to make politics</em></td>
<td><em>designing and making things analysis and synthesis</em></td>
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<td>EE-theories: $\sigma$-theory</td>
<td>EE-theories: $\beta$-theory, $\nu$-theory</td>
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<th>Ontological Theories</th>
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<td><em>understanding the nature of things and their use explanation and prediction</em></td>
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<td>EE-theories: $\phi$-theory, $\delta$-theory, $\pi$-theory, $\psi$-theory, $\tau$-theory</td>
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<th>Philosophical Theories</th>
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<tr>
<td><em>understanding thinking</em></td>
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<tr>
<td>epistemology, mathematics, phenomenology, logic</td>
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<td>EE-theories: $\omega$-theory</td>
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The $\psi$-theory ($\psi$ is pronounced as PSI, standing for Performance in Social Interaction) is a theory about the ontological essence of social systems. It clarifies and explains the construction and operation of organisations.

The $\psi$-theory is rooted in the $\pi$-theory, speech act theory [Austin, Searle], social action theory [Habermas], systemic ontology [Bunge] and information systems theory [Langefors]. It consists of two parts: the general $\psi$-theory and the special $\psi$-theory.

The **general $\psi$-theory** is a theory of human cooperation. Therefore, it is also called the **human face** or **front side** of the $\psi$-theory.

The **special $\psi$-theory** clarifies the consequences of the general $\psi$-theory for the systems approach to organisations. Therefore, it is also called the **system face** or **back side** of the $\psi$-theory.
The general $\psi$-theory

The operating principle of organisations is that **subjects** (humans) **enter into and comply with commitments**

Commitments are raised and dealt with in **transactions**. These are interaction structures of **coordination acts/facts** regarding a **production act/fact** between two actors: one of them is the **initiator** (consumer) and the other one is the **executor** (producer)

The effect of a coordination act is the creation of a coordination fact, which is a state change in the **coordination world** of the organisation

The effect of a production act is the creation of a production fact, which is a state change in the **production world** of the organisation
Examples of coordination acts

Alicia: *I’d like to have a bouquet of red tulips*

Alicia: **request**: Celestine: **order 387 is completed**

Celestine: *Just a moment*

Celestine: **promise**: Alicia: **order 387 is completed**

Celestine: *Here you are*

Celestine: **state**: Alicia: **order 387 is completed**

Alicia: *Thanks*

Alicia: **accept**: Celestine: **order 387 is completed**
Coordination and production acts/facts

These state changes occur according to the universal transaction pattern. Did you see the pattern?
The complete transaction pattern
The complete transaction pattern
The complete transaction pattern
The complete transaction pattern
The organisational building block

An **actor role** is the authority to be executor in exactly one transaction kind. It may be an initiator in 0, 1 or more transaction kinds.

A subject may fulfill several actor roles (sequentially or simultaneously), and an actor role may be fulfilled by several subjects (sequentially or simultaneously or collectively).
An actor A0 (the initiator of T1) comes to agreement with an actor A1 (the executor of T1) about the delivery of a product P1.

Basically, A0 doesn’t need to care about what A1 has to do in order to produce P1.

At some point in time, A1 addresses A0 and performs the state act in the transaction T1.
In order to produce P1, A1 needs a P2, a P3 and a P4! And ...

NOTE: component transactions may also be carried out in parallel.
The special $\psi$-theory

The special $\psi$-theory takes the systems approach to organisations. Being the back side, PSI is read backwards (ISP), with two meanings:

**Intelligent System Partitioning**

Every organisation can be partitioned in three aspect organisations:

- **B-organisation** (B from Business)
- **I-organisation** (I from Information)
- **D-organisation** (D from Document and Data)

**Integrated System Perspectives**

The ontological model of an organisation is the integration of four sub models: **Construction Model**, **Process Model**, **Fact Model**, and **Action Model**
ψ-theory: Intelligent System Partitioning

- **B-organisation**: creating, deciding, judging
- **I-organisation**: remembering, recalling, computing
- **D-organisation**: storing, retrieving, transmitting, copying

uses \( \Rightarrow \) supports

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What is the essential model? (1)

The **essential model** of an organisation is the ontological model of its **B-organisation**:

abstracted from **realisation**:
from the **I-organisation**
from the **D-organisation**

abstracted from **implementation**:
from **coordination technology**
from **production technology**
What is the essential model? (2)
ψ-theory: Integrated System Perspectives

COORDINATION

actors
transactions

business processes
business events

business rules
work instructions

PRODUCTION

business objects
business facts

CM
PM
FM
AM
Case Volley: the essential model in DEMO

- **Volley: Construction Model (1)**
  - T1: membership start
  - T2: membership payment
  - CA1: aspirant member
  - CA2: payer

- **Volley: Process Model**
  - membership start
  - membership payment
  - CA1: aspirant member
  - A1: membership starter
  - CA2: payer

- **Volley: Fact Model (1)**
  - Membership
  - Person
  - membership start: T1
  - membership payment: T2
  - CA1: aspirant member
  - A1: membership starter
  - CA2: payer

- **Volley: Action Model - action rules for A01 (1)**
  - when membership start for new Membership is requested with the number of Membership to a Person, the starting day of Membership is a Day
  - assess: the performer of the request is the (aspirant) member of Membership
  - accuracy: < no specific condition >
  - truth: Day is the first day of some Month; Month is greater than Current Month; the age of Person is equal to or greater than the minimal age in the year of Day; the number of members on Day is less than the max members in the year of Day
  - if complying with request is considered justifiable then promise membership start for Membership [T1/pm] else decline membership start for Membership [T1/dc]
By abstracting from realisation and implementation (of the B-organisation), a reduction of about 80% is achieved.

By ‘compressing’ the complete transaction pattern into one symbol, another reduction of about 80% is achieved.

In total, this amounts to a reduction of more than 95%!
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In biology, a distinction is made between the *genotype* and the *phenotype* of organisms.

The phenotypes of identical twins may differ considerably (notably in the course of time).

Conversely, people with different genotypes may have quite similar phenotypes.
Genotype and phenotype of organisations

Also regarding organisations, a distinction can be made between genotype and phenotype.

The **genotype** of an organisation is defined as its **essential model**.

The **phenotype** of an organisation is defined as the **realisation** and **implementation** of the essential model.

**Realisation** is devising the I-organisation and the D-organisation of the essential model.

**Implementation** is allocating technological means to actor roles, and to coordination and production acts/facts.
The phenotype of a bank (1)

How can I help you, sir?
I want to withdraw money request
From your current account?
Yes
How much do you want?
400 euro please
employee fills out a form
If you sign here please
client signs the form
One moment please
employee issues banknotes
Here you are, sir
Thank you

state accept
Welcome to the ING bank
Please insert your card
*client inserts card*

Enter your PIN please
*client keys the PIN*

Choose the amount please
*client presses € 400*

Take your card please
*client takes the card*

Your money is being counted
*banknotes are produced*

Take your money please
*client takes the banknotes*

*request promise state accept*
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The β-theory (β is pronounced as BETA, standing for Binding Essence, Technology and Architecture) is a theory about the design of systems (in any category).

It clarifies and explains such terms as “development”, “design”, “engineering”, and “implementation”.

The β-theory is rooted in systems thinking [Bertalanffy, Bunge, Checkland]), in general design theory [Simon], and in software design theory [Dijkstra].
The Generic System Development Process

- **Object System**
- **Ontology**
- **Function**
- **Analysis**
- **Iteration**
- **Construction**
- **Synthesis**
- **Architecture**
- **Implementation**
- **Technology**

**Using System Construction**

**Reverse Engineering**

**Constructional Principles**

**Functional Principles**

**Function**

**Requirements**

**Synthesis**

**Design**

**Implementation**

**Technology**

**Analysis**

**Object System Function**

**Object System Construction**
The Design of an EIS

- B-organisation
- Organisation
- EIS
- Functional specs
- Architecture
- Functional principles
- Constructional principles
- Design
- Construction
- Implementation
- Technology
- Using system construction
- Reverse engineering
- Engineering
- Object system construction
What is an enterprise information system?

The enterprise information system (EIS) of an enterprise is some implementation of some realisation of its essential model.

This insight stresses the intrinsic and intense intertwining of an enterprise information system with the supported organisation.

Conclusion: one cannot just deploy some EIS ‘from the shelve’!

Instead, proper requirements engineering is needed. Completeness and relevance of the requirements can only be guaranteed if they are based on its genotype: the essential model of the organisation.
The proper EIS metaphor

an *EIS* vis à vis the supported organisation

is like

a *nervous system* vis à vis the supported *body*

the *nervous system* is intrinsically and intensely intertwined with the *body*
How well do ERP systems fit?

Like every EIS, an ERP system is some implementation of some realisation of the essential model of some organisation. But which one?

ERP vendors don’t seem to know and don’t seem to care much.

As a consequence, ERP systems are doomed to fail or to be a life-long ‘armour’ for the organisation.
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By applying the PSI-theory, one reveals the essential model of an organisation

By applying the BETA-theory, one designs the supporting I-organisation, starting from this essential model

If the implementation technology will be ICT, one can skip the design of the D-organisation.

The resulting EIS will perfectly satisfy the functional requirements of the supported organisation

It will also perfectly fit the operational requirements, i.e. the user interface specifics, because of the complete transaction pattern

Now you know why ERP systems fail ... and will keep failing ... until ERP vendors hire enterprise engineers
In this afternoon’s tutorial, you will learn how enterprise engineers design EISs.