Modelling Sustainable Systems and Semantic Web

Organisations as Systems

Lecture in the Module 10-202-2312
for Master Computer Science

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What is a System?

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A *system* is a set of elements that are interconnected and interact with each other, forming a unified whole that possesses properties that are not already contained in the constituent elements considered individually.

TRIZ Ontology Project

The necessity of the use of the term "system" occurs when it is required to emphasize that something is large, complex, immediately not wholly comprehensible, but at the same time a unified whole.

Unlike the notions "set" or "aggregate", the concept of a system emphasises the ordering, the integrity, the regularity of construction, functioning and development.

What is a System?

In all these definitions, the *structuredness* and thus *decomposability* of the system in the analytic dimension is emphasised on the one hand, and the *interdependence* and thus *indecomposability* in the operating dimension on the other.

In addition to the components, the *connecting elements* also play an important role. They mediate the *flow of energy, material and information* that is required for the operation of each component.

Viable Components

Viable components deliver processual services in *guaranteed* quantity and quality during operation, if the *external operational conditions* are guaranteed.

These processual services of the components altogether in combination form the emergent function of the overall system.

What is a System?

Self-similarity of the concept

Components can be considered as systems, where the upper system guarantees the required for operation throughput of energy, material and information.

System concept as description of complicated real-world phenomena by reduction to the essentials.

(1) Outer demarcation of the system against an *environment*, reduction of these relationships to input/output relationships and guaranteed throughput.

(2) Inner demarcation of the system by combining subareas to *components*, whose functioning is reduced to "behavioural control" via input/output relations.

(3) Reduction of the relations in the system itself to "causally essential" relationships.

What is a System?

Such a reductive description (explicitly or implicitly) exploits output from prior life:

(1) An at least vague idea about the (working) input/output services of the environment.

(2) A clear idea of the inner workings of the components (beyond the pure specification).

(3) An at least vague idea about causalities in the system itself, that precedes the detailed modelling.

Organisations as Systems

This lecture topic aims to shed more light on the connection between the concepts of system and (social) organisation.

Social organisations such as companies, associations, projects, unions, parties, governments, states ... are undoubtedly theoretically delimitable and practically delimited parts of reality with outwardly (and inwardly) directed goals and purposes whose internal structure and dynamics are driven by an external throughput of energy, material and information, and which can therefore be studied from a systemic perspective.

These throughputs are already mentally charged in language form in a **more complex social context** and in the form of interests, needs, monetary flows and power relations.

Systematic Management Basics

Systemic development of social organisations is taking place in the unity and difference of *planned action* and *experienced results*.

This requires a concept of *action planning*, based on a *conceptual understanding* of the process landscape within and around the organisation in an appropriate explicit form of description and *intelligible operational actions*.

▶ Planning and experience

▶ Dialectical relation of tension between plan and reality

▶ Practical real-world development and *practice of thinking*

▶ Feedback relation between planning and experience

Organisation

Formal Organisation (Wikipedia)

An organisation that is established as a *means for achieving defined objectives* has been referred to as a formal organisation.

Its design specifies how *goals are subdivided and reflected* in subdivisions of the organisation. Divisions, departments, sections, positions, jobs, and tasks make up this work structure.

Thus, the formal organisation is expected to *behave impersonally* in regard to relationships with clients or with its members. [...]

A *bureaucratic structure* forms the basis for the appointment of heads or chiefs of administrative subdivisions in the organisation and endows them with the authority attached to their position. (my emphasis)

Organisation

Informal Organisation (Wikipedia)

[...] The informal organisation expresses the personal objectives and goals of the individual membership.
Their objectives and goals may or may not coincide with those of the formal organisation. [...]

Digression to ORG and FOAF ontologies.

- ORG: `https://www.w3.org/TR/vocab-org`
- FOAF: `http://xmlns.com/foaf/spec/`

Discussion

The ORG Ontology

`org:OrganizationalUnit`, `org:FormalOrganization` and
`org:OrganizationalCollaboration` as subconcepts of the
concept `org:Organization`.

Organisation

… represents a collection of people organised together into a
community or other social, commercial or political structure.

The group has some common purpose or reason for existence
which goes beyond the set of people belonging to it and can act as
an Agent.

Organisations are often decomposable into hierarchical structures.

Organisation

`org:Organization` is related to `foaf:Agent`

... the class of agents; things that do stuff. A well known sub-class is `foaf:Person`, representing people. Other kinds of agents include `foaf:Organization` and `foaf:Group`.

A `foaf:Group`

... represents a collection of individual agents (and may itself play the role of a Agent, i.e. something that can perform actions).

This concept is intentionally quite broad, covering informal and ad-hoc groups, long-lived communities, organisational groups within a workplace, etc. ...

Organisation

While a Group has the characteristics of a Agent, it is also associated with a number of other Agents (typically people) who constitute the Group, its members. ... The basic mechanism for saying that someone is to use the member property of the Group to indicate the agents that are members of the group.

The terms Agent and Group thus introduce self-similar concepts of structures that are *capable of action*. This corresponds to the legal construction of a *juridical subject* in the sense of the Civil Code (BGB) if *responsibility for the consequences of action* is added.

Organisation as Socio-Technical System

This corresponds closely with the *system concept developed so far*:

A *system* is a *delimited set of elements* (components, objects, resources) that are interconnected and interact with each other. Their interaction realises a *qualitatively new function* (emergent function) and thus constitutes a *new unified whole*.

A system has a *structural* and an *operational* dimension which are in contradictory dialectical relation of decomposability and indecomposability.

The *operation of a system* requires a qualitatively and quantitatively defined throughput of energy, material and information.

Organisation as Socio-Technical System

Ian Sommerville *Software Engineering* also starts with the concept of a system and moves from there to the concept of *organisation*.

System

A system is a meaningful set of interconnected components that work together to achieve a specific goal.

Organisation as Socio-Technical System

Technical computer-based systems

… are systems that contain hardware and software components, but not procedures and processes. … Individuals and organisations use technical systems for specific purposes, but knowledge of that purpose is not part of the system.

For example, the word processor I use does not know that I am using it to write a book.

Organisation as Socio-Technical System

Socio-technical systems

… contain one or more technical systems, but beyond that – and this is crucial – the knowledge of how the system should be used to achieve a broader purpose.

This means that these systems have *defined work processes*, *human operators* as integral part of the system, are *governed by organisational policies* and are *affected by external constraints* such as national laws and regulations.

Essential Characteristics of Socio-Technical Systems

▶ They have special properties that affect the system as a whole, and are not related to individual parts of the system. These special properties depend on the system components and the relationships between them. Because of this complexity, the system-specific properties can only be evaluated when the system is composed.

▶ They are often not deterministic. The behaviour of the system depends on the human operators and on other people who do not always react in the same way. Also, the operation of the system can change the system itself.

Essential Characteristics of Socio-Technical Systems

▶ The extent to which the system supports organisational goals
depends not only on the system itself. It also depends on the
stability of the goals, the relationships and *conflicts between
organisational goals*, and how people in the organisation
interpret those goals.

In this context, there is a clear shift on the scale of controllability
from direct control (technical systems) to indirect control
(socio-technical systems), which in **socio-economic systems** with
a large number of stakeholders or even **socio-ecological systems**
shifts further in the direction of movement according to intrinsic
laws ("natural processes").

Discussion

Shchedrovitsky on Organisations

What is an organisation for Shchedrovitsky? He distinguishes three dimensions of that notion

- ▶ Organisational work as practical activity.
- ▶ Organisation as the result and means of organisational work.
- ▶ Organisation as a form of life of the collective.

Organisational Work

When we organise we collect something. We need some structural elements ... We must collect these elements in a particular way, and we must establish some kind of connection and relations between them. When we are doing this sort of work we must impose some organisational form on these elements. [. . .]

Organisation as the Result and Means of Organisational Work

Organisation as the result of organisational work can be regarded as both an **artificial entity** and as **naturally living thing**.

The main question is: why does the organiser create a particular organisation? The organisation acts here as an **artificial entity**. It has a purpose (Zweck) and can be considered ... in terms of the functions that it, the organisation (system!), must provide. ... These are all characteristics that are seen from an artificial point of view.

As a tool, as a means, **as an artificial entity, the organisation does not and cannot have goals** (Ziele). Organisers can have goals. But for their goals, in relation to their goals, the organisations they create are a means, a means for them to achieve their goals.

Organisation as a Form of Life of the Collective

The organisation has been created, and it has begun to live its own life. And then it turns out that, from a natural point of view, other goals may appear in this organisation – the goals of the collective, which was organised. Generally, something quite different begins, this **organisation begins to live its own life**. Then we [. . .] must seek forms, methods, laws of the life of the groups and the collectives within organisations.

When the organisation is seen from a natural viewpoint, it is not yet the means, but the **form**, the **condition** of the life of the collective (the people) who work in it.