The duality of technology.
Rethinking the concept of technology in organizations
by
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In this paper Orlikowski presents a new model for analyzing the nature and role of technology in organizations, which she terms as the structurational model of technology
Orlikowski refers to previous research studies in the fields of technology and organisations have focused on the following views:

**View 1:**
Technology is an objective, external force that have deterministic impact on organizational properties such as structure

**View 2:**
A human action aspect of technology - where technology is the outcome of strategic choice and social action
Orlikowski suggest that both models are incomplete, and proposes a reconceptualization of technology that takes both perspectives into account.

She proposes a structuration model of technology, built on the basis of this new conceptualization by exploring the relationship between technology and organizations. The presented view of technology in this paper is based on Giddens’ “Theory of Structuration” (1976, 1979, 1984).
Two important aspect of the technology concept:

- **Scope**—What is defined as comprising technology
- **Role**—How is the interaction between technology and organizations defined
Differences in Scope

- Hardware scope (equipment, machines and instruments that humans use in productive activities) – technology variable only useful to organizations that employ machines in productive activities

- Social technologies scope (generic tasks, techniques, knowledge) technology variable useful when human take part in productive activities
Technology as an objective, external force that have deterministics influence on organizational properties such as structure

Human action aspect of technology

Technology as an external force having impacts, but these impacts are moderated by human actors and organizational context
Technology Imperative Model

- A model used in studies of technologies and information technology, given the premise that the technology, as well as the organizational and individual variables can be measured and predicted.
- Ignores the action of humans in developing, appropriating and changing technology.
- Treat technology as an independent influence on human behaviour or organizational properties.
The Strategic choice Model

3 directions / themes are described:

1. How particular technology (as depended variable) is physically constructed through the social interactions and political choices of human actors. Typically Socio-technical studies IT designed for different intentions like automate (controll, deskill) or informate (empower, upskill) - after work of Zuboff)

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1. How particular technology (as depended variable) is physically constructed through the social interactions and political choices of human actors. Typically Socio-technical studies IT designed for different intentions like automate (controll, deskill) or informate (empower, upskill) (after work of Zuboff)

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2. A second stream examines how shared interpretations around a certain technology arise and affect the development of and interaction with the technology. Empirical studies adopting this social constructionist view of technology by sociologist of technology

- Lacking material and structural aspects of interaction with technology
3. A third research stream is represented by Marxist accounts of technology. Describing the manner the technology is developing and deployed to further the political and economic interests of powerful actors

- Lacking dealing adequately with human agency in the workplace.
- Only management and technology designers have the authority and means to shape the technology.
A third perspective on the relationship between technology and structure: by Barly (1986, 1990) who portrates technology as an intervention into the relationship between human agents and organizational structure, which potentially change the structure.

- Technology is seen as a social object, whose meaning is defined by the context it is used in, he is not taking into account the need for physical modification of technology during use of it.
Orlikowski’s Scope - restrict the concept scope to material artifacts (various configurations of hardware and software)

- Material artifacts as the outcome of coordinated human action and hence as inherently social

Orlikowski’s Role - mutual interactions between human agents and technology. The interactions are socially constructed and structural.
A structurational model of technology

- Orlikowski suggests to understand the technology from the point of view of structuration.

- Structuration is posited as a social process that involves the reciprocal interaction of human actors and structural features of organizations.
The theory of structuration

- Recognizes that human actions are enable and constrained by structures, yet that these structures are the results of previous actions.

- Giddens framework (theory of structuration) present structure as a generic concept that is only manifested in the structural properties of social systems (Giddens 1979: 65-65)
The theory of structuration

- A central premise is that actors are knowledgeable and reflexive.

- Giddens: "all social actors, all human beings are highly "learned" in respect of knowledge which they possess and apply, in the production and reproduction of day-to-day social encounters."

- Giddens differentiate between discursive (what is said by actors) and practical knowledge (what is simply done by actors, tactilly).

- Reflexive refers to the capacity of humans to routinly observe and understand what they are doing while they are doing it.
The theory of structuration

- Actors’ knowledge and reflexivity is always limited to some extent by the situated nature of actions, the difficulty of articulating tacit knowledge, unconscious sources of motivation, and unintended consequences of actions (Giddens, 1979:144)

- Duality of structure—The balancing of agency (human action) and structure (rules and resources (authoritative and allocative))

Social structure make social action possible, and at the same time that social action creates those very structures.
The theory of structuration

- Giddens introduces three fundamental elements of social interaction (1976):

  - **Meaning** (human interaction involves the constitution and communication of meaning) constitute organizational structure of signification.

  - **Power** (the power of human action to transform the social and material world -> transformative capacity), constitute organizational structure of domination. Always potential for agents to act to change a particular structure of domination (referred to as dialectic of control by Giddens).

  - **Norms** (organizational conventions or rules governing legitimate or "appropriate" conduct), constitute organizational structures of legitimation.

Premises of structurational model of Technology

- First premise: Technology is created and changed by human action, however technology is also used by humans to accomplish some action, which is what Orlikowski calls the duality of technology.

- Second premise: Technology is interpretively flexible, however interaction of technology and organization is a function of the different actors and socio-historical contexts implicated in its development and use.
Orlikowski identifies prior views of technology as either objective force or as socially constructed product— as a false dichotomy.

Technology is the product of human action, while it also assumes structural properties.

Furthermore, technology is:

- physically constructed by actors working in a given social context
- socially constructed by actors through the different meaning they attach to it, various features they emphasize and use
- BUT: the duality of technology may be suppressed in organizational discourse in favor of a dualism which emphasize only one view of technology
The process of development and use are often carried out in different organizations regardless of time and space. Many actions that constitute the technology (ex. vendor site) are often separated in time and space from the actions that are constituted by the technology (ex. Customer sites).

- Time-space discontinuity is related to notion of temporal scope.

- Dualistic view of technology as a fixed object or as a product of human action is influenced by the different temporal stage that researches have focused on.
The Interpretive flexibility of Technology

- Researchers that are focusing on design and development -> less likely to treat technology as a objective or external force (as strategic choice studies).

- Researchers that are focusing on use and utilization of a technology in an office or factory -> less likely to look at how users of technology are influencing by it, and how technology affects institutional properties in the organization.
Orlikowski suggests that we recognize human interaction with technology as having two iterative modes:

- The design mode
  - schemes (rules reflecting knowledge of the work being automated)
  - Facilities (resources to accomplish that work)
  - Norms (rules that define the organizationally sanctioned way of executing work)

- The use mode
  - Assigning shared meaning to technology
  - Influencing the human agents appropriation of the interpretive schemes, facilities, and norms designed into the technology
The Interpretive flexibility of Technology

- The term interpretive flexibility refer to the degree to which users of a technology are engaged in its constitution (physically or / and socially)during the development or use.

- Interpretive flexibility is an attribute of the relationship between humans and technology and hence it is influenced by characteristics of: the material artifacts (e.g specific hardware and software comprising the technology), human agents (e.g experience, motivation) and contexts (social relations, task assignment, resource allocations)
The structuational model of technology comprises the following components:

- Human agents as technology designers, users, decision makers

- Technology – material artifacts mediating task execution in the workplace

- Institutional properties of organizations, including organizational dimensions such as environmental pressure (e.g. government regulation), competitive forces, vendor strategies, professional norms, state of knowledge about technology with more
## Components of Structurational model of technology

<table>
<thead>
<tr>
<th>Type of influence</th>
<th>Nature of influence</th>
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<tbody>
<tr>
<td>A Technology as a product of human action</td>
<td>Technology is an outcome of such human actions as design and developement, appropriate and modification</td>
</tr>
<tr>
<td>B Technology as a medium of human action</td>
<td>Technology facilities and constrains human action through provision of interpretive schemes, facilities and norms</td>
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<tr>
<td>C Institutional conditions of interactions with technology</td>
<td>Institutional properties influence humans in their interaction with technology</td>
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<tr>
<td>D Institutional consequences of interaction with technology</td>
<td>Interactions with technology influence institutional properties of an organization, through reinforcing or transforming the structure of signification, domination and legitimation</td>
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Using the structurational model of technology

- Orlikowski’s field research study, in 1987 at Beta Corporation, a large multinational software consulting firm
- Majority of Beta’s employees are functional consultants, developing customized application systems for clients. A small proportion are technical consultants (into research and development)
- Invested large in information technology in the production work of its consultants
- A transform from labor intensive - paper-based set of activities into a rationalized, capital intensive production process - (tool -> CASE)
Using the structurational model of technology

- Research methodology: observation study of participants + historical review of Beta
- Field study duration: 8 months
- Location: in Beta and in those clients sites where Beta developers were building application systems
- New technology developed by the technical consultants after commissioned by management
Stage I: Initial development

- CASE tool were produced through human agency of Beta’s technical consultants.
- Actions by technical consultants were influenced by Beta institutional properties, notably the existing institutional knowledge and norms of Beta’s system development methodology (structure of signification and legitimation), and resources (time, money, authority) distributed to the technical consultants by senior managers (structure of domination).
Stage II: Institutional Use of technology

- Once developed the tools were distributed on project teams.
- As a medium of human action, the tool can be seen as both constrain and facilitate the activities of consultants.
- The tool is built so the work is executed in a standardised, structured, and predictable manner, which leave little discretion in the hands of individual consultants.
Stage III: Ongoing interaction with Technology

- The CASE tool were designed and implemented by BETA management and technical consultants to increase efficiency of production work through rationalization and standardization. Today the tool serving employees that were not involved in development of the tools. -> discourages reflectiveness. However, knowledge and reflexive human agents are capable of altering the controlling influence of the technology. -> given certain conditions the individual modifies their use of technology.
- The tool was characteristic with low interpretive flexibility, on the whole. Some consultants are able however to recognize the constructed nature of the tool
- Consultants reacted against the tool -> tool imposed unreasonable constrains on their behaviour.
- Result was that the tool functionality was modified
- This example indicates that technology is NOT a fixed object at any stage during its development.
This paper explores a number of issues that changes the way we think about and study the interaction of technology and organizations.

Two key aspects of technology have been highlighted: duality of technology and its interpretive flexibility, both masked by the time and space disjunctures implicated in different stages of a technology’s interaction with organizations.

Technologies are products of their time and organizational context, and will reflect the knowledge, materials, interests and conditions at the given locus in history.