On a variety of research output types

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Abstract

It is important that research work services both science and practice. When researchers base or relate their research to the earlier studies, they must pay attention to the type of research. Practitioners try to recognize the value of new research results, to assimilate them and apply them to commercial ends. The new classification of research approaches puts a question: Do the research outputs of different approaches differ? The answer is affirmative. This study shows that research output type can vary from a) descriptions of reality, to b) constructs, c) (descriptive and prescriptive) models, d) (positive and normative) methods, e) instantiations, and f) proofs. This variety is in concordance with the classification of research approaches, and creates many other important implications.

Keywords: research method, research output, theory, model, construct

Introduction

What is the importance of a certain research question? Who would benefit from having an answer and in what ways? Those are questions we researchers must state before we start our study. We, of course, can present many reasons from the scientific viewpoint. But our study is more important, if its output has a great effect both on other researchers and on practitioners.

We have recently developed a new classification of research methods (Järvinen 1999, Järvinen 2000). It seems to be more logical, sensitive and denser than the earlier ones. Hence, it is interesting to study, *which kinds of research output type can be expected from applying different research approaches*. We define a *research approach* as a set of research methods that can be applied to the similar research objects and research questions, and *output type* as an abstraction of singular facts, concepts or relations etc.

Many method books contain only one research method, e.g. Fink and Kosecoff (1985), Fowler (1988), Marsh (1982), Moser and Kalton (1989), de Vaus (1996) for survey studies; Glaser and Strauss (1967), Glaser (1978), Strauss (1987), Strauss and Corbin (1990) for grounded theory; and Yin (1989) for case study. Some case study types belong to the same research approach as the survey method, and some other ones to the same approach as the grounded theory (cf. Cunningham (1997) and Järvinen (2000)). Hence, to exploit the results of the recent studies researchers and practitioners must master more than one research approach to a certain extent, at least know and differentiate their possible research output types.

During the last hundred years the mankind has moved from manual work via equipment-supported work to knowledge-intensive work, where scientific and technological knowledge play a central role. The time from the discovery to its applicable innovative use is much shortened. The work force must be capable to rapidly exploit the results of scientific studies.

In the rest of this paper we first present our classification of research approaches. Instead of presenting the classification only we like to shortly show the classification criteria and the whole classification procedure. We then use to demonstrate different research output types from different approaches. In addition to presenting research output types in general, we familiarize each approach by taking one example study and its concrete results. Finally we summarize our results, show some implications and new research challenges.

Järvinen's classification of research approaches

In the development of our taxonomy of research approaches the top-down principle is applied, i.e. all the research approaches is first divided into two classes, one or both are then divided again into two sub-classes etc. (Figure 1). At the beginning we differentiate other methods from mathematical methods, because they concern formal languages, algebraic units etc., in other words, symbol systems without having any direct reference to objects in reality. From the rest of methods concerning reality we then use research questions in differentiation. Two classes are based on whether the research question refers to what is a (part of) reality or does it stress on utility of an artifact. From the former we differentiate conceptual-analytical approaches, i.e. methods for theoretical development, from empirical research approaches.

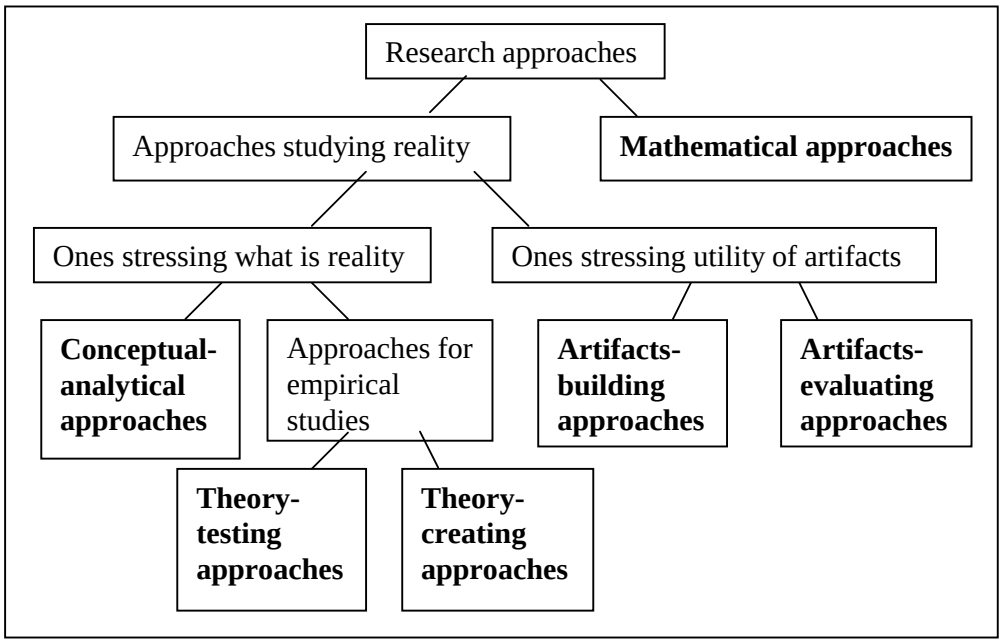

Figure 1: Järvinen's taxonomy of research methods

When we empirically study the past and present, we use theory-testing or theory-

creating methods depending on whether we have a theory, model or framework guiding our study or are we developing a new theory grounded on the gathered raw data. Regarding artifacts we either build or evaluate them as March and Smith (1995) suggest. (Please, note that an *artifact* refers to a human-made construction possibly containing physical, human and data resources; hence its meaning is little broader than traditionally.)

Our taxonomy of *research approaches* consists of I) mathematical approaches, II) conceptual analytical approaches, III) theory-testing approaches, IV) theory-creating approaches, V) artifact-building approaches, and VI) artifact-evaluating approaches.

Examples representing approaches

We shall structure our detailed analysis of research output types according to those research approaches. In the next sections we shall take an example study for each research approach. The selection of the examples is based on our idea to find a good representative of that approach. Hence our examples do not concern the one topic only. In addition, we prefer to pick up the recent studies published in the highly ranked journals and such ones, which might be interesting for both information systems researchers and practitioners.

Mathematical approaches

In *mathematical* studies a certain theorem, lemma or assertion is proved to be true in a particular context of fundamental mathematical pre-suppositions. The research question could then be as follows: Can we prove this theorem to be true?

Aulin (1982, 112-115) derived the Law of Requisite Hierarchy from the Law of Requisite Variety by supposing that a regulator R1 is incapable of reducing the variety of original disturbance H(D) to the required level of survival, $H(E_0)$. The situation may be saved, if we have another regulator R2 that can be put to regulate further the outcome Y1 of the first regulator. This may be still insufficient. But then, if we have a third regulator to handle the outcome Y2 we can proceed and go until a regulator of order m will yield a satisfactory result. In general case, the uncertainty term $H_D(R)$ for m regulators in the sequence will reduce the effective regulatory ability. Some controllers Gj, or a hierarchy of controllers to guide regulators Ri are then needed.

The Law of Requisite Hierarchy can be expressed as follows:

The weaker in average are the regulatory abilities and the larger the uncertainties of available regulators, the more hierarchy is needed in the organization of regulation and control to attain the same result of regulation, if possible at all.

The research output of this example is The Law of Requisite Hierarchy; its *proof* demonstrates that it holds with very loose assumptions concerning entropy.

Conceptual analytical approaches

In *conceptual-analytical* studies two different sub-approaches are normally identified. First, we can start from the assumptions, premises and axioms and derive the theory, model or framework. A researcher could ask: Which kind of theory concerning a certain part of reality could be derived, if certain assumptions and premises are valid? Second,

the empirical studies performed earlier are analyzed and their results (generalizations) integrated. A researcher could then ask: Is there any common theory, which describes and explains those phenomena?

From the assumptions to the theory

We take Wand and Wang's (1996) study on the model of four intrinsic data quality dimensions (Table 1) as an example of this research type. They assume that an information system (IS) is a representation of a real-world (RW) system as perceived by users.

Table 1: Intrinsic data quality dimensions (Wand and Wang 1996)

D.Q. Dimension	Nature of Associated Deficiency	Source of Deficiency
1. Complete	Improper representation: missing IS states	Design failure
2. Unambiguous	Improper representation: multiple RW states mapped to the same state	Design failure
3. Meaningful	Meaningless IS state and Garbling (map to a meaningless state)	Design failure and Operation failure
4. Correct	Garbling (map to a wrong state)	Operation failure

Dimension 1 refers to instances where certain RW states cannot be represented. It causes loss of information about the application domain. The situation can be repaired by modifying IS to allow for missing cases.
Dimension 2 refers to an instance where a certain IS state can be mapped back into several RW states. In the IS there are insufficient information; the data can be interpreted in more than one way. This may require adding states to the IS.
Dimension 3 refers to an instance that it is not possible to map the IS state back to a meaningful RW state. The situation can be repaired by reducing the IS to include only meaningful states. This can be done by adding integrity constraints.
Dimension 4 refers to an instance where the IS state may be mapped back into a meaningful state, but the wrong one. The data derived from the IS do not conform to those used to create these data. Reducing this garbling can be done by adding some controls.

All descriptions of four dimensions above as such give much information to practitioners. Wand and Wang (1996) still propose that, first, data quality dimensions can be used to develop data quality audit guidelines and procedures; second, data quality metrics can be developed for use in specification and audit of information systems. - In general, the great advantage of this type of approach 'from assumptions to the theory' is the fact that it often produces an exhaustive set of dimensions or *constructs* as research output, and hence it explicitly shows all the alternatives.

From earlier studies to an integrated theory

In this research type we use Cohen and Levinthal's (1990) study on an absorptive capacity as an example. They argue that the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends is critical to its innovative capabilities. They label this capability a firm’s absorptive capacity and suggest that it is largely a function of the firm’s level of prior knowledge. Their discussion focuses first on the cognitive basis for an individual’s absorptive capacity including, in

particular, prior related knowledge and diversity of background. They then characterize the factors that influence absorptive capacity at the organizational level, how an organization's absorptive capacity differs from that of its individual members, and the role of diversity of expertise within an organization. They argue that the development of absorptive capacity, and, in turn, innovative performance are history- or path-dependent and argue how lack of investment in an area of expertise early on may foreclose the future development of a technical capability in that area. They formulate a model of firm investment in research and development (R&D), in which R&D contributes to a firm's absorptive capacity.

Cohen and Levinthal (1990) offer some implications of absorptive capacity for the analysis of other innovative activities, including basic research, the adoption and diffusion of innovations, and decisions to participate in cooperative R&D ventures. They claim that firms may conduct basic research less for particular results than to be able to provide themselves with the general background knowledge that would permit them to exploit rapidly useful scientific and technical knowledge through their own innovations or to be able to respond quickly - become a fast second - when competitors come up with a major advance. - Cohen and Levinthal's (1990) perspective implies that the ease of learning, and thus technology adoption, is affected by the degree to which an innovation is related to the pre-existing knowledge base of prospective users. They give an example how personal computers diffused more rapidly at the outset among consumers and firms who (late 1980ties) had prior experience on mainframes or minicomputers. - Cohen and Levinthal (1990) also show that the importance of absorptive capacity also helps explain some recent findings regarding firms' cooperative research ventures. They are actually found more typically in industries that employ more mature technologies rather than in industries in which technology is moving ahead quickly. Cohen and Levinthal (1990) also recommend that those firms who are attempting to encourage cooperative research ventures in quickly advancing fields should recognize that the direct participation in the venture should represent only a portion of the resources that it will take to benefit from the venture. - Cohen and Levinthal (1990) derived the *integrated theoretical* proposition that "a firm's absorptive capacity is largely a function of the firm's level of prior knowledge" from the many empirical studies.

Theory-testing approaches

In the *theory-testing* studies such methods as laboratory experiment, survey, field study, field experiment etc. are used. In the study where the theory-testing method is used the theory, model or framework is either taken from the literature, or developed or refined for that study. The research question could then be read: Do observations confirm or falsify that theory?

We here take the most common study type (cf. Orlikowski and Baroudi 1991), a survey, performed by Hann and Weber (1996) as our example. According to them empirical studies of information systems planning practices in organizations indicate that wide variations exist. They propose and test a model based on agency theory and transaction cost economics to account for these variations. As senior management's uncertainty with respect to the information systems function increases, Hann and Weber argue that senior management will delegate more decision rights to the information manager. As a result of increased agency costs, senior management will demand more information systems planning to provide the basis for monitoring and bonding of the manager. In addition, because information systems plans may be used to resolve the

distribution of gains and losses between senior management and the information systems manager in the event of unforeseen circumstances, both senior management and the information systems manager will seek to exercise control over the planning process and the form of the final plan. Hann and Weber argue that the relative specialization of human capital of senior management versus the information systems manager will dictate whose views dominate in the preparation of and form of the information systems plan.

Hann and Weber presented their propositions and results based on survey and interview data in Table 2.

Table 2: Propositions based on the IS planning model and empirical support obtained (Hann and Weber 1996)

Proposition	Result	
1. Higher levels of senior management uncertainty relating to the IS function will be associated with higher levels of delegation of decision making rights to the IS manager	Not supported	
2. Higher levels of senior management uncertainty relating to the IS function will be associated with higher levels of IS planning	Not supported	
3. Higher levels of senior management uncertainty relating to the IS function will be associated with senior management exercising higher levels of control over the IS planning process	Mixed support	x
4. Higher levels of IS manager uncertainty relating to the IS function will be associated with higher levels of IS planning	Not supported	
5. Higher levels of IS manager uncertainty relating to the IS function will be associated with senior management exercising lower levels of control over the IS planning process	Not supported	
6. Higher levels of senior management dependency on the IS manager will be associated with senior management exercising lower levels of control over the IS planning process	Supported	x
7. Higher levels of senior management control over the IS planning process will be associated with higher levels of senior management's goals and objectives being reflected in the IS plan	Supported	xx
8. Higher levels of senior management's goals and objectives being reflected in the IS plan will be associated with higher levels of usefulness of the IS plan as a bonding, monitoring, and governance mechanism	Supported	xx
9. Higher levels of IS planning will be associated with higher levels of usefulness of the IS plan as a bonding, monitoring, and governance mechanism	Not supported	
10. Higher levels of usefulness of the IS plan as a bonding, monitoring, and governance mechanism will be associated with higher levels of delegation of decision making rights to the IS manager	Not supported	
11. Higher levels of usefulness of the IS plan as a bonding, monitoring, and governance mechanism will be associated with lower levels of *ex post* agency costs relating to the IS manager	Supported	xxx
12. Higher levels of delegation of decision making rights to the IS manager will be associated with lower levels of *ex post* agency costs relating to the IS manager	Not supported	

x = supported by survey data only, xx = supported by both survey and interview data, xxx = supported by interview data only.

Table 2 shows that the minority of the propositions received support and *the model only slightly confirmed*. Alternative explanations are sometimes given to the propositions not supported.

Theory-creating approaches

To the *theory-creating* approach we include the "normal" case study, ethnographic method, grounded theory, phenomenography, contextualism, discourse analysis, longitudinal study, phenomenological study, hermeneutics etc. A researcher could then ask: Which kind of construct or model could explain the observations gathered? Which theory could explain why acts, events, structure and thoughts occur?

In our example Barley (1996) lays the groundwork for new models of work and relations of production that reflect changes in the division of labor and occupational structure of a postindustrial economy. It demonstrates how new ideal-typical occupations can be constructed, drawing on a set of ethnographies to propose an empirically grounded model of technicians' work. The paper focuses on two questions: What do technician do and what do they know? The answers constitute a first cut at the ideal type, technician. The paper then turns to evidence of difficulties that arise when organizations employ technicians but fail to appreciate the nature of their work. It close by showing how a contextually derived model of technicians' work enables us to evaluate why some recent trends in organizing are congruent with an increasing technical workforce, why others may be misguided, and why organizations are likely to face challenges that organizational theorists have but vaguely anticipated. The paper shows that the emergence of technicians' work may signify a shift to a more horizontal division of substantive expertise that undermines the logic of vertical organizing on which most organizational theory and practice still rests.

According to Barley most occupations have historically revolved around the manipulation of things, symbols, or people. Work focused on things has traditional entailed little responsibility for symbols or people, and vice versa. In many systems of production, however, material and symbolic work cannot be completely segregated. When important symbols represent material phenomena, symbolic work will lack accuracy unless the symbolic and the material are linked. The core of technicians' work lies in creating these linkages.

Although the substance of technicians' work varied widely across the occupations Barley studied, his group found that all technicians worked at an empirical interface: A point at which a production system met the vagaries of the material world. Using sophisticated instruments, techniques, and bodies of knowledge, technicians stood with one foot in the material world and the other in a world of representations. Depending on the occupation, the material entities were computers, software, microorganisms, the human body, a manufacturing technology, or another mechanical system. Similarly, depending on occupation, relevant representations consisted of data, test results, images or diagnoses. As Figure 2 indicates, bridging the material and the representational pivoted around two complementary processes, transformation and care-taking. Figure 2 is one formulation of the *model* created for describing technicians' work.

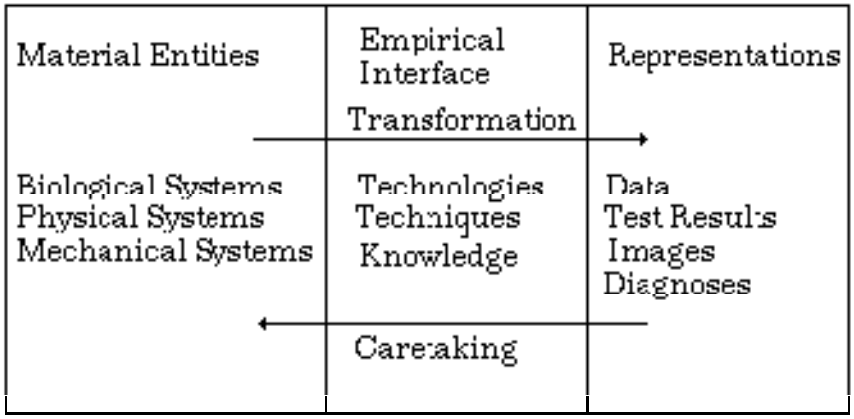

Figure 2: The non-relational aspects of technicians' work: The empirical interface. (Barley 1996, 419)

According to Barley transformation and care-taking at an empirical interface highlight the core of technicians' work: They are what makes technicians' work technical. But to understand technicians' role fully, one must also consider the social meaning of their work, which rested on how they were situated in a local division of labor. Whereas the non-relational structure of technicians' work was constant across all occupations Barley and his group studied, they found that technicians were positioned in organizations in two different ways: as what they buffers (Figure 3) and brokers (Figure 4).

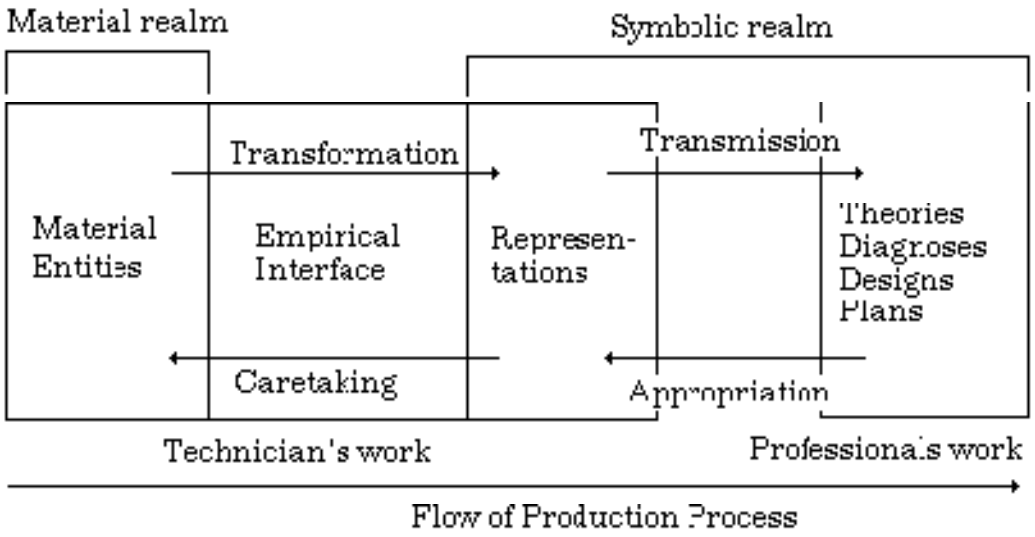

Figure 3: Buffer technicians

The flow of production moves from left to right, with the technician first reducing physical phenomena to representations and then conveying those representations to a professional, who operates on the representations to synthesize a more complex symbolic product. Buffers routinely appropriated the professionals' theories, plans, diagnoses, or

designs to guide their own work at the empirical interface.

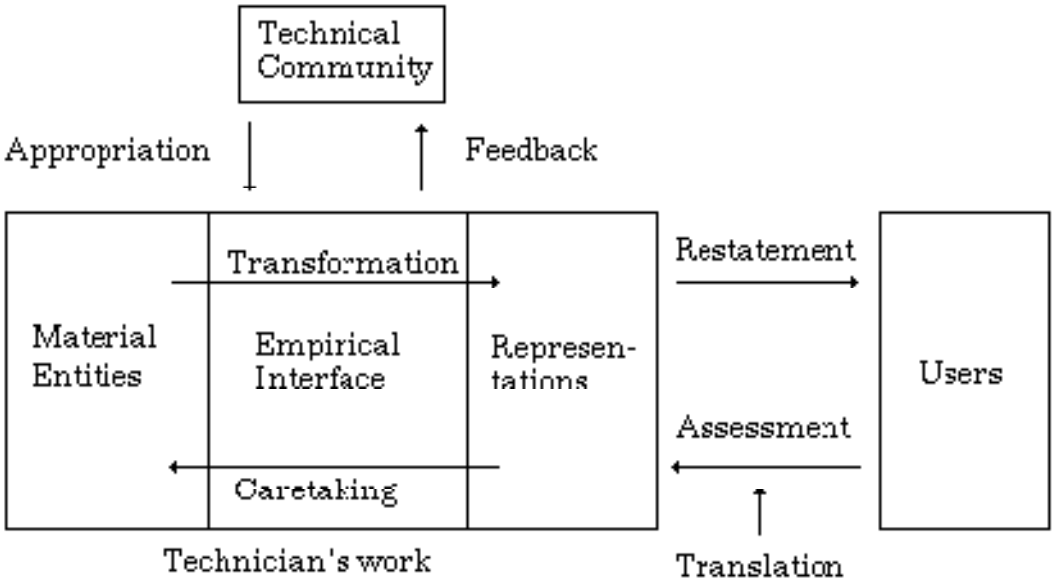

Figure 4: Broker technicians

Brokers in the Barley's study (1996) bridged two communities: the users they served (either permanently or temporarily) and the technical community associated with the technology for which they were responsible. The work entailed adapting the technical community's knowledge and products to the contextually specific needs of users, clients, or customers. Figures 3 and 4 refine the new *model* (Figure 2) of technicians' work.

Artifact-building approaches

In *building* a new artifact the utility aspects are emphasized and a particular (IS) development model is applied. The research question could be: Is it possible to build a certain abstract or concrete artifact, i.e. a new information system, method, form of organizing or measurement instrument etc.?

Our example concerns a development of a new method, actually its goals. It is taken from the article written by Truex et al. (1999) where the authors paid attention to the emergent organizations. According to them "the current frenzied pace of organizational change is being driven by the rapid development of commercial technology, global markets and reengineered, quality-oriented organizations. This constant need to change gives rise to a recognition that organizations in the present are no longer stable, but are continuously adapting to their shifting environments. These organizations can be said to be in a state of constantly seeking stability, while never achieving it."

Truex et al. argue that the old information systems development (ISD) goals are obsolete under assumption of emergent organizations. Hence they propose an alternative goal set that arise from emergent assumptions (Figure 5).

Figure 5: Mapping old assumptions to new perspectives

Levers to stimulate emergence:	Revoked ISD goals:	Emergent ISD goals
Shared reality construction	Economic advantages of lengthy analysis	Always analysis
	User satisfaction	Dynamic requirements negotiations
Self-reference and organizational identity	Abstract requirements	Incomplete, usefully ambiguous specifications
	Complete and unambiguous specifications	
The dialectics of organizational autopoiesis	New system projects as achievements	Continuous redevelopment

In the new goal set the first, second, and last items stand in contrast to the first, second, and fifth items from the revoked set of traditional ISD goals. And the new third goal is an implied response to the revocation of the third and fourth items in the old goal set.

Truex et al. (1999) describe those four new goals as follows:

Always analysis. Under emergent assumptions, the analysis of IS applications must be continuous. Since the organization is emerging, the fundamental IS must continuously change and adapt. In order to implement this adaptation, requirements and specifications are constantly renegotiated. Analysis activities are no longer captured within the early stages of a system's life cycle. Instead, these activities are an ongoing service of the organizational ISD group. It is important to realize that this ongoing service must not be cyclical (periods of analysis followed by periods of implementation), but is generally a constant ISD activity in parallel with systems operation and maintenance.

Dynamic requirements negotiations. Because the organization is emerging around the users, IS requirements can never be fully specified because users are always in conflict with them. Thus user satisfaction is improbable. Indeed, under this assumption, a setting where users are fully satisfied would be an alarming anomaly. Requirements are no longer determined as part of a project, but become a negotiated outcome of the changing characteristics of an emergent organization and the resources for enhancing or altering the existing IS.

Incomplete, usefully ambiguous specifications. If abstract requirements are largely imaginary, and unambiguous specifications are ineffectual, analysts must come to terms with ambiguity. Because the requirements are in motion, specifications must be kept in a state in which these can be easily adapted for enhancing or modifying the existing system. The goal is a set of specifications wherein each specification is open-ended and easily modified.

Continuous redevelopment. Under emergent assumptions, this goal supplants the current ISD project mentality under which all systems terminate at their obsolescence point. The goal of ISD is to preserve all existing IS applications by continuously enhancing and modifying these to match organizational requirements. The goal of ISD is to prevent system obsolescence and thereby eliminate system termination (and the implied new ISD project).

Because of the emergent assumptions Truex et al. (1999) do not propose any structured *method*, but they recommend to apply four new goals in the continuous maintenance work as separate steps of the methodology.

Artifact-evaluating approaches

In *evaluation* of the artifact, e.g. an information system, some criteria are used and some measurements performed. A researcher could ask: How effective or utile is this artifact?

In our example Dutta and Segev (1999) look at the ways commercial organizations are exploiting the Internet. They choose the classical marketing strategic model of '4Ps' (Product, Price, Promotion, Place) to underpin the research, augmented with two additional factor - Technological Sophistication and Customer Relations. Dutta and Segev used the following dimensions and their items in evaluation of web sites of the very big corporations in different sectors. The web pages are the artifacts in this evaluative study.

Technological sophistication
¤ The ease of navigation of the site;
¤ The degree of customization possible of the Web interface;
¤ Speed and ease of access to site features; and
¤ Advanced technological capabilities (such as video)

Transformation of products
¤ The availability of product related information on-line;
¤ The customization of products for individual or groups of customers; and
¤ The participation of customers in the specification and design of products.

Transformation of promotion
¤ The use of on-line advertising;
¤ The use of on-line promotions such as sales and discounts;
¤ The customization of on-line promotions;
¤ The participation of customers in on-line promotions; and
¤ Links with other organizations in organizing on-line promotions.

Transformation of pricing
¤ The availability of pricing information on-line;
¤ The dynamic customization of prices;
¤ The availability of on-line price negotiation; and
¤ The possibility to charge customers for only proportions of products consumed.

Transformation of place
¤ The availability of on-line ordering;
¤ The availability of secured on-line payment;
¤ Distribution of products on-line; and
¤ The involvement of partner organizations in on-line distribution.

Transformation of customer relations
¤ The provision of on-line customer service;
¤ The on-line identification and tracking of customers to provided customized

services;
¤ The provision of on-line communications to customers;
¤ The creation of on-line communities for customers; and
¤ The solicitation of on-line feedback from customers.

The results of evaluation are given as figures and the percents in figures are based on positive rankings of the subsets of items under a certain dimension.

Their results show that most large corporations and multinationals are making little use of the Internet, treating it simply as a publishing medium. Traditional corporations are loath to take risks and are therefore vulnerable to flexible and fast-moving new entrants moving onto the Internet. In this respect, there is little difference between US and European or Asian firms.

The authors insist that focus on the customer is the correct prescription, which, however, is not easy to implement. All sectors of industry must seek to exploit the Internet for competitive advantage. - The research output are *evaluative descriptions* how commercial organizations are exploiting the Internet

Output types of different approaches in general

In this section we try to find various research output types in general. We shall proceed by amplifying the list of March and Smith (1995), which we rank as the best one this far. They defined four design science products as follows: *Constructs* or concepts form the vocabulary of a domain. A *model* is a set of propositions or statements expressing relationships among constructs. A *method* is a set of steps (an algorithm or guideline) used to perform a task. An *instantiation* is the realization of an artifact in its environment. Instantiations operationalize constructs, models and methods (Figure 6).

		Research Activities			
		Design science		Natural science	
		Build	Evaluate	Theorize	Justify
Research Outputs	Constructs				
	Model				
	Method				
	Instantiation				

Figure 6: A research framework (March and Smith 1995)

The list developed by March and Smith contains three abstractions and an artifact, but it does not contain any descriptions of states or events in reality. Hence, we supplement the list with *descriptions of a part of reality*. March and Smith did not separate mathematical approaches (compare Figures 1 and 6), but we repeat that there are mathematical systems do not have any reference to reality. The research output is then *proofs*. Another difference between Figure 1 and 6 is the utility aspect emphasized with research outputs. This utility aspect connected with the model refers to the goal function of this model describing the initial state or the desired target. This stresses the prescriptive - orders or directions giving (instead of descriptive) nature of the model. The utility aspect

connected with the method brings the normative - 'ought to' (instead of positive - 'is') view in. Our list of *research output types* is: a) descriptions of reality, b) constructs, c) (descriptive and prescriptive) models, d) (positive and normative) methods, e) instantiations, and f) proofs.

By using those research output types we can summarize our results in Table 3.

Table 3: General and specific research output in different research approaches

Research approaches	Research output, from our examples	Research output, general
I) Mathematical ones	Law of Requisite Hierarchy	Proofs
II) conceptual analytical ones a) from the assumptions to the theory b) from earlier studies to an integrated theory	a) Four intrinsic data quality dimensions: incomplete, ambiguous, meaningless and incorrect ones b) the generalization that "a firm's absorptive capacity is largely a function of the firm's level of prior knowledge"	Constructs, descriptive models and positive methods derived by using alternative a) or b)
III) theory-testing ones	Some (but not all) propositions like "higher levels of senior management control over the IS planning process will be associated with higher levels of senior management's goals and objectives being reflected in the IS plan" supported	Theory, descriptive model, positive method or framework is confirmed or falsified possibly supplemented with alternative explanations and modifications better suitable for observations from reality.
IV) theory-creating ones	In technicians' work two complementary processes, transformation and care-taking are bridging the material and the representational. Technicians were positioned in organizations in two different ways: as buffers and brokers	Based on observations on a certain part of reality a new (preliminary) theory, descriptive model, positive method or construct is derived, or that part of reality is described.
V) artifact-building ones	Four new emergent ISD goals are proposed: 1. Always analysis, 2. dynamic requirements negotiations, 3. incomplete, usefully ambiguous specifications and 4. continuous redevelopment	A certain abstract or concrete artifact, i.e. a new information system, prescriptive model, normative method or measurement instrument, is built,
VI) artifact-evaluating ones	Most large corporations and multinationals are making little use of the Internet, treating it simply as a publishing medium.	The utility (efficiency, effectiveness etc.) of a certain artifact (or prescriptive model or normative method) is evaluated by using some criteria.

Discussion

Both our examples and general analysis of research approaches and results clearly show the variety of research output types. The entries in the last column of Table3 much differ from each other. Table 3 as such also supports our classification of research methods in Figure 1. Those conclusions have many important implications.

The variety of research output types must be taken into account when we are preparing the literature survey needed in every scientific study. It is not reasonable to combine descriptive and prescriptive models nor positive and normative methods into the same category of models or methods, respectively. To support the correct classification we must in our research report explicitly inform readers about those characteristics of models and methods.

In order to be capable to identify those differences presented in Table 3 both researchers and practitioners must be adequately taught in formal education. This means that the whole set of research approaches and their output types must be included into the course of research methods.

Parallel with the former we now better than earlier understand Cohen and Levinthal (1990) when they found that "firms may conduct basic research less for particular results than to be able to provide themselves with the general background knowledge that would permit them to exploit rapidly useful scientific and technological knowledge through their own innovations or to be able to respond quickly - become a fast second - when competitors come up with a major advance".

The large variety of research output types may also explain why researchers sometimes have difficulties to communicate their results to practitioners or to other group of researchers. Boland and Tenkasi (1995) analyzed knowledge-intensive firms with specialities and knowledge disciplines. They called a group of specialized knowledge workers with term "community of knowing". The authors argue that producing knowledge requires the ability to make strong perspectives within a community, as well as the ability to take the perspective of another into account. Some common boundary objects are needed in communication between two groups of researchers and/or practitioners.

Boland and Tenkasi (1995) presented two models of communication (language game and conduit) and cognition (narratives and information processing) for amplifying our thinking. Those models can offer a good starting point to perform an empirical study how do researchers and practitioners communicate. We can more explicate our research problem by asking which aspects of certain research output type support and restrict successful communication.

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