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Applying Facets of Work as a Source of Knowledge and Insight for Requirements Determination

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Abstract. This conceptual contribution explains how the idea of "facets of work" can bring more knowledge and richer, more evocative ideas to the development of system requirements in organizational settings. Focusing on facets of work potentially provides useful guidance without requiring unnecessary details, precision, and notation. A background section summarizes how the current research emerged from partial overlaps between separate research efforts. Table 1 identifies 18 facets of work. Five other tables look at a subset of the facets to illustrate concepts associated with specific facets, common success factors and tradeoffs, sub-facets and other topics. Use of the same subset of the facets to classify quotations from a case study demonstrates the broad relevance of the approach.

Keywords: Facet, Facets of work, Systems analysis and design, Business process management, Capability, Process, System

1 Seeing IT-Reliant Processes and Systems as Much More than Sequences of Steps

Widely accepted methods and teaching materials in SA&D, BPM, and enterprise modeling (EM) emphasize rigorous modelling and tend to ignore or downplay research and experience that could help in describing, understanding, and analyzing business activities and systems. The high rate of disappointment with system development projects in complex situations implies that there is plenty of room for new forms of requirements determination and new tools and methods for SA&D.

Facets of work. This paper is a conceptual contribution that introduces the idea of facets of work, which is based on an analogy to the multiple facets of a cut diamond. That idea leads to seeing work activities and systems as much more than steps triggered by other steps or by specific conditions. The idea of "facets of work" is almost totally absent from the literature. An Apr. 29, 2020 Google Scholar search on "facets of work" returned only 3600 hits, almost all of which were about other topics such as facets of work value, facets of work-life balance, facets of work autonomy, facets of work support, and so on.

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Practical challenges in creating, operating, and improving IT-reliant activities, processes, and systems involve many issues and ideas that are not captured well using BPMN, EPC, ArchiMate and other formal modeling approaches. The idea of facets of work links to multiple paths for accessing knowledge that might help. Much of that research and experience is related to topics such as decision making, communication, coordination, improvisation, value creation, and other focal points for describing and understanding how and how well work is performed. Those focal points and many others bring concepts and other knowledge that can provide important insights regardless of whether tcchnically-oriented or socially-oriented approaches are used.

Increased awareness and organized visibility of knowledge from research and practice that might help with long-standing, unsolved IS problems related to failed projects and disappointing impacts on business performance. In many cases, part of the problem is inattention to existing knowledge about decision making, communication, improvisation and other topics that are treated as unimportant or beyond the scope of techno-centric views of systems and system development.

Tables describing facets of work. This paper explains the concept of *facet of work* and identifies 18 facets of work. Important aspects of those facets appear in six tables. A seventh table uses quotations from a published case study to demonstrate the broad applicability of selected facets.

- Table 1 shows that all 18 facets of work are significant in many situations.
- Table 2 uses the first six facets to illustrate that facets of work apply to sociotechnical work systems and to totally automated work systems.
- Table 3 illustrates that facets of work bring concepts and other knowledge more directly related to each facet than to other facets.
- Table 4 illustrates that facets of work brings common success criteria and design tradeoffs.
- Table 5 illustrates that most facets have sub-facets that may provide guidance for looking at specific facets of work in greater depth.
- Table 6 illustrates open-ended questions and follow-ons for each facet.
- Table 7 illustrates the practical applicability of the idea of facets of work by using facets of work to organize quotations from a case study called "The Update: Why Doctors Hate Their Computers" (Gawande, 2018)

All 18 facets appear only in the Table 1 due to this paper's length limitations. The other tables show only the first six facets but suffice in illustrating the main points. A Dec. 2019 paper for the JAIS theory development workshop presented *facets of work* in much greater detail including more background, complete versions of all tables, and many more references. Feedback from the workshop is reflected in this paper.

Goal and organization. The idea of facets of work grew out of an attempt to bring richer and more evocative concepts to SA&D, BPM, and EM in order to expand their scope and facilitate analyst/stakeholder interactions. This paper integrates aspects of past research that focused on topics ranging from enterprise modelling to psychology. A key goal is to provide useful guidance to process- and system-related discussions

without requiring attention to burdensome details, precision, and notation that are useful to technical experts after initial understandings and requirements are attained.

This paper defines *facets of work* and explains how that concept can be applied in requirements determination and SA&D. A background section identifies diverse research topics that contributed to this paper's ideas about facets of work. The main section identifies 18 common facets of work, i.e., facets that apply to varying extents to most activities, capabilities, processes, and operational systems. Each facet brings concepts, knowledge, sub-facets, and open-ended questions that can be applied when discussing requirements for proposed and existing processes and systems. Overall, this paper's ideas are designed to encourage business stakeholders and IT professionals to engage with much more than process steps or use cases of computerized tools.

2 Background

The current research emerged from partial overlaps and conceptual leaps between separate research efforts that were explained more fully in the theory development workshop paper mentioned earlier. The first leap involved the realization that the idea of "an overarching modelling metaphor" (Ferstl and Sinz 2013) that guided modelling research reported in Alter and Bork (2019) and Bork and Alter (2020) might be linked to previous research in Alter (2013a) that tried to develop an approach for applying metaphors in the broader IS discipline. In the second leap, familiarity with capability-driven development (CDD) led to realizing that system capabilities could be seen as a way to summarize a system without specifying its detailed process flow (the second item in the vertical dimension in Figure 1). The third leap came from thinking about how a "higher specificity" (the horizontal dimension in Figure 1) view of system capabilities might be expressed using facets of capabilities. The fourth leap came from recognizing that facets of work would be a more useful central metaphor for achieving current purposes. Key ideas along that path are as follows:

Subsystem types and related metaphors. This paper grew out of an attempt to improve upon ideas presented in Alter (2013a), which explored whether common types of subsystems (not standard IS categories such as MIS and DSS) might provide direction, insight, and useful methods for SA&D. That research attempted to build on earlier publications that applied metaphors for understanding complex, multi-faceted topics, e.g, Ima*ges of Organization* (Morgan 1986) and use of metaphors in system development (Kendall and Kendall, 1993; Oates and Fitzgerald, 2007). Those examples inspired an attempt to identify generic subsystems that seem to embody different metaphors. A major obstacle to useful application of a generic subsystem metaphor was the common expectation that subsystems should be contiguous and non-overlapping. For example, a specific system may contain a sequence of 10 steps, of which steps 3 and 7 involve decision-making and steps 3 and 5 involve communication. The decision-making and communication subsystems would not be contiguous, would overlap in some places, and would not include other steps that might be im-

portant to understand. The idea of facets of work overcomes that problem because facets do not need to occupy a contiguous space within a process or system.

A design space for modelling methods and techniques. A quite different project related to shortcomings of formal modeling methods led to wondering whether the generic subsystem idea might be re-cast in a more useful way. Prominent researchers from various backgrounds have noted that modelling methods related to processes and enterprises have not achieved their full potential and need to be extended or augmented to make them more usable by broader user groups and for broader purposes, e.g., Sandkuhl et al. (2018), van der Aalst (2012) and Karagiannis (2015). Related research on modelling method usage (e.g., Fettke, 2009; Mendling et al. 2010) and model comprehension (e.g., Haisjackl et al., 2018; Johannsen et al., 2014; Mendling et al., 2018) highlights major issues. Modelling methods often do not fit modelers' aptitudes, knowledge, and purposes (Hinkel et al., 2016). Simões et al. (2018) cites research regarding stakeholders and notes that the "lack of intuitiveness of diagrammatic representations and the complementary role of text-based representations has been underlined in recent research." The general issue of cognitive load (Sweller, 1994) for stakeholders becomes increasingly important with the proliferation of unfamiliar symbols and icons. Simões et al. (2018) also mentions issues such as lack of flexibility in models, dilemmas of control, and excessive prescriptiveness.

An attempt to address the above concerns led to the possibility of allowing a given modeling method to support diverse purposes of different stakeholders by relaxing constraints about the relationship between modeling techniques and modeling methods described in Karagiannis and Kühn (2002) and Bork and Fill (2014). In turn, that idea led to proposing the two-dimensional design space in Figure 1 and applying that design space to modeling using a work system metaphor at the heart of work system theory (WST) and the work system method (WSM) as discussed in Alter (2013b)

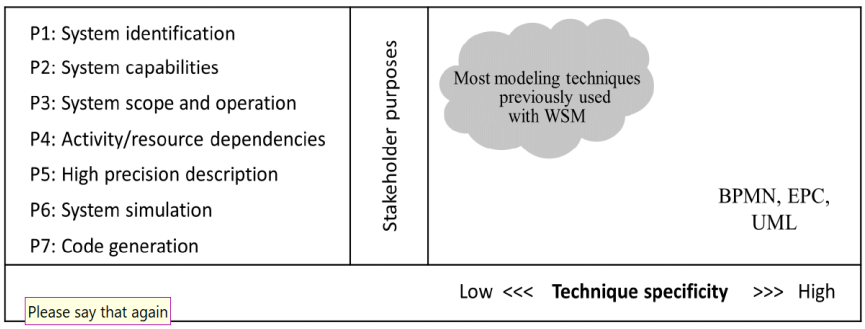

Figure 1. Design space for modelling techniques (Authors, 2019a).

The vertical dimension in Figure 1 expresses the idea that different types of techniques are required for different stakeholder purposes that range from largely informal (P1 and P2) to somewhat formal (P3 and P4) to highly formal and structured (P5, P6, P7). Technique specificity, the horizontal dimension in Figure 1, is the extent to which a modelling technique defines exactly what to include, what to ignore, and how to proceed. Informal techniques with low specificity may be flexible but provide rela-

tively little conceptual or procedural guidance. Techniques with high specificity (e.g., using BPMN or ArchiMate) provide much more conceptual or procedural guidance but often at the cost of complexity, training time, and discomfort and high cognitive load for non-expert users.

P2, the second purpose in Figure 1 is about system capabilities. According to Authors (2019a), "P2, system capabilities, calls for identifying main capabilities but not necessarily operational details, e.g., a list of capabilities of a hiring system, a heating system, or a search system." Subsequent discussions led to concluding that capabilities is a valuable idea in Figure 1 and in many situations, but that its connotation of not involving a specified process or system is too limiting for the purposes of the current research. That led to moving from facets of capabilities to facets of work.

Associating work with activities, capabilities, processes, and systems. For our purposes, work is the use of resources to produce outputs or results. For example, in relation to work system theory (WST), work is defined as the "use of human, informational, physical, and other resources to produce product/services." (Alter 2013b, p. 82). Use of WST to visualize work performed systematically establishes an organized approach to topics that have been discussed from many perspectives. In WST, a work system is system in which human participants and/or machines perform work (processes and activities) using information, technology, and other resources to produce products/services for internal and/or external customers. The first *and/or* in the definition implies that work systems can be sociotechnical or totally automated. (People who build or maintain automated systems do not participate in those systems; rather, they participate in separate systems that create or maintain the automated systems.)

Facets. The term facet has been used with disparate meanings and connotations in psychology library science, information science, computer science, and other disciplines. Those uses are not directly related to this paper's notion of facet.

3 Facets of Work

This paper's approach to facets of work defines facet in a way that resembles the meaning of facet for a gemstone: one side of something that is many-sided. Thus, a *facet of work* is one of many sides of work. The term *aspect* might have been used instead of facet, but the term aspect also is applied in many ways in many different fields, e.g., aspect-oriented programming in computer science. The idea of facets of work is based on a set of assumptions:

Focus on activity. Each facet of work is identified using a verb or verb phrase since work in business settings always involves activities that are expressed using verbs.

Multiplicity of facets. Work has many facets. For example, work related to hiring new employees involves making decisions, communicating, processing information, and so on. People initiating analysis of that kind of situation can explore questions

about facets of the relevant work without needing to document operational details, performance levels, or other information that deeper analysis would require.

Broad applicability. The various facets of work can be applied for thinking about real-world activities, capabilities, processes, and operational systems.

Generic concept. The concept of *facet of work* is generic. I.e., the same facets and related ideas can apply to many different situations even though a given facet may not apply significantly to work in specific situations.

Inclusion criteria for facets. These include understandability, wide applicability, and direct association with concepts and knowledge not as closely related to other facets.

Independence not required. Facets of work may overlap, as when making decisions in a situation calls requires processing information and communicating (two other facets). Making decisions is a separate facet of work because many concepts are much more related to making decisions that to any of the other facets of work.

Selection of current 18 facets. The 18 facets in Table 1 were selected in a highly informal manner starting with the 8 subsystem types and related ideas in Alter (2013a). Iterative inspection of articles and case studies identified possible facets of work that were missing. The current set of facets could be improved based on discussion and application. Deriving a formally justified set of facets in the future might be worthwhile if the idea of facets of work proves useful in practice or in research.

Applicability to sociotechnical and totally automated systems. Almost all facets apply equally to sociotechnical work by people and totally automated work by machines. The main exception is the facet *interacting socially*, and even that one might be used for quasi-social interactions of automated entities in the future. (see Table 2)

Facet-related concepts and knowledge. Each facet brings concepts and other knowledge that is not typically associated with other facets. (see Table 3)

Evaluation criteria and design trade-offs. Most facets imply evaluation criteria and design trade-offs that are more related to that facet than to other facets. (see Table 4)

Sub-facets. Many facets have broadly applicable sub-facets. For example, sub-facets of information processing include capturing, transmitting, storing, retrieving, manipulating, displaying, and deleting information. (see Table 5).

Open-ended questions. Most facets imply open-ended questions and follow-ons that can be used in initial stages of describing or analyzing systems. (see Table 6)

Broad recognition. Table 7 shows facets of work in a published account of the operation and impact of electronic medical record system in a major organization.

3.1 18 common facets of work

Table 1 identifies and provides a brief comment about18 common facets of work. Each facet can be used for discussing and exploring activities, processes, and operational systems at various levels of depth. Each brings related concepts and other knowledge even though some facets overlap to some extent. Discussion of the facets does not require rigorous diagramming tools that belong in subsequent analysis and problem solving. A longer paper could cite numerous references for each facet.

Table 1. 18 common facets of work

Facet	Importance of considering this facet
Making decisions	Treating decisions simply as steps in a process is often inadequate if there are issues and opportunities related to the rationale or quality of decisions.
Communicating	Inadequate communication is a common complaint in business situations. Often the problem is not about specific steps but rather about clarity, involvement, relationships, personality conflicts, and other issues.
Processing information	Most business situations involve some form of information processing by people and/or machines. Digitalization increases reliance on information processing by machines.
Thinking	While artificial intelligence and related topics receive a great deal of attention, many work situations simply require ability and time to think carefully and sometimes creatively.
Representing reality	Many information systems represent reality in ways that are misleading, for example by providing inadequate options for coding problems or incidents.
Providing information	In many business situations people complain that they are not informed adequately about information or situations they should know about.
Applying knowledge	Significant business situations typically require the application of general and/or specialized knowledge which may be tacit or explicit.
Planning	Inadequate planning is often viewed as a reason for disappointing results even though there are some situations where improvisation is quite important.
Controlling execution	Options for controlling the execution of work attempt to find appropriate tradeoffs between inadequate control and excessive surveillance.
Improvising	Work in many settings involves improvisations and workarounds, especially when work is relatively unregulated and when exceptions and other conditions require deviation from established practices.
Coordinating	Efficient and effective operation of an organization calls for coordination between people and groups performing related tasks and/or sharing resources.
Performing physical work	Trends towards digitalization coexist with the continuing importance of creating, modifying, moving, or adjusting physical objects.
Performing support work	Process documentation often does not include support work (also called articulation work) that helps in coordinating work activities, overcoming obstacles, and obtaining needed resources in a timely manner.
Interacting socially	Inadequate social interaction may degrade work performance by lessening cooperation, whereas excessive social interaction may generate inefficiencies such as absorbing too much time.
Providing service	Consideration of service aspects is often important because the purpose of most work activities is to produce things, actions, or conditions that facilitate benefits for others.

Creating value	Direct attention to value is important because the intention of producing things for others does not imply that value is created either for the intended beneficiary or the people or organizations that perform the work.
Co-creating value	Increasing attention to value co-creation calls for observing whether and how it occurs and whether it might occur more efficiently or effectively.
Maintaining security	Privacy concerns compound many threats that have emerged due to the ease of access and moving inadequately guarded digital information.

Open-ended questions. Each of the facets in Table 1 could be the topic of at least two open-ended questions at the beginning of a description or analysis process.

- Where is this facet of work important in this situation?
- What are important issues or opportunities related to this facet?

Those open-ended questions could jumpstart requirement-related discussions. Facets that seem unimportant initially can be set aside in order to focus on facets that seem most relevant for system description, management concerns, and speculation. Table 6 identifies typical open-ended questions that are directly related to each facet of work.

Why these facets? All 18 facets were identified through an informal and highly iterative process of asking whether ideas in many articles might qualify as a facet of work based on two criteria: 1) broad applicability and 2) association with a set of concepts that are more related to that facet than to other facets.

Elements of various recognized frameworks might have been used for a similar purpose but would not have focused directly on activities or groups of activities. For example, the work system framework (Alter, 2013b) might have provided facets called customer, product/service, processes and activities, and so on. The Leavitt diamond model (Wigand, 2007) might have provided four facets: people, task, structure technology. CATWOE from soft system methodology (Checkland, 2000) might have provided six facets: customers, actors, transformation process, worldview, owners, and environmental constraints. The main elements in diagrams summarizing activity theory (e.g. Engeström, 1990) might have provided mediating artefacts, subject, object, rules, community, division of labor, and outcome. Sub-models in the 4EM language for enterprise modelling might have brought goals, business rules, concepts, business processes, actors, and resources. (Stirna and Persson, 2018). None of those approaches fit the idea of facets of work because at most one of the elements of each of those approaches refers specifically to activities or groups of activities.

3.2 Relevance to sociotechnical and totally automated work systems

Table 2 illustrates that the first six of the 18 facets are relevant to both sociotechnical work systems and totally automated work systems. It is easy to produce the same types of examples for the other facets.

Table 2. Relevance to both sociotechnical and totally automated systems

Facet	Sociotechnical work performed by people	Automated work performed by machines controlled by software
Making decisions	People provide information that supports a decision process. Example: Marketing manager decides on allocation of advertising budget.	Computer uses software algorithms to make decisions automatically. Example: Marketing model calculates automatic budget allocations.
Communicating	People communicate with other people as part of collaboration. Example: Sales managers meet to discuss issues and trade-offs.	Computer communicates an alert to human users. Example: A computer highlights last week's key performance gaps.
Processing information	People capture, transmit, store, delete, retrieve, display, or manipulate data. Example: A researcher collects, filters and summarizes information.	Computer or other device performs information processing activities. Example: information processing via RFID, MRI, or digital camera
Thinking	People think about a situation to identify important issues. Example: A doctor considers medical evidence that may be relevant.	A computer processes data to identify situationally important issues. Example: A computer uses an algorithm to identify relevant facts.
Representing reality	People create a representation of reality. Example: Financial analysis by an accountant produces financial reports.	A computer uses software and data to create a representation of reality. Example: Facial recognition system identifies people in a location.
Providing information	People provide information upon request or on a periodic basis. Example: Employee submits a progress report before a weekly meeting	Computer provides information, by subscription or on demand. Example: Automated news service customizes a daily newspaper.

3.3 Concepts related to common facets

Table 3 identifies common concepts related to the first six of the 18 facets. The key point here is that many of those terms are only tangentially associated with established techniques of SA&D, BPM, and EM even though many of the facets often could provide important clues about what is needed. Literature reviews for each facet would find many concepts and generalizations that have been researched in depth.

Table 3. Concepts associated with the first six of 18 facets

Facet	Related concepts
Making decisions	Decision, criteria, alternative, value, risk, payoff, utility, utility function, tradeoff, projection, optimum, satisficing vs. optimizing, heuristic, probability, distribution of results, risk aversion
Communicating	Comprehension, one-way vs. two-way, messages, utterances, encoding, transmitting, decoding, interpreting, communication channel, media, media richness, wired, wireless, signal-to-noise ratio, attenuation

Processing information	[nouns] entity, relationship, data item, class, method, object, event, state, process, pre-condition, post-condition, business rules, [verbs] capture, transmit, store, delete, retrieve, manipulate, display, initialize, initiate, update, back-up, restore, roll back
Thinking	Thoughts, facts, concepts, images, perceptions, memories, awareness, consciousness, reasoning, realizations, imagination
Representing reality	Entity, event, state, inclusion, exclusion, filtering, summarization, precision, bias, characteristic, measure of performance
Providing information	Inclusion, exclusion, accuracy, conciseness, focus, filtering, outlining, textual vs. graphical presentation, types of graphical displays, personal style related to information usage, information deficiency, information overload

3.4 Success criteria and design trade-offs related to each facet

Table 4 shows that each facet suggests typical success criteria and design tradeoffs. Some of the criteria and design trade-offs are common to most activities, processes, and systems, but others are mostly associated with specific facets. Many other success criteria and design tradeoffs could be mentioned in a more complete coverage.

Table 4. Typical evaluation criteria and design trade-offs

Facet	Typical evaluation criteria	Typical design trade-offs
Making decisions	Decision outcomes, riskiness, participation, concurrence, ease of implementation	• Quick responsiveness vs. superficiality. • Complexity and precision of models vs. understandability • Brevity vs. omission of important details
Communicating	Clarity, understandability, conciseness, accuracy of the perception of a message, empathy, warmth, signal to noise ratio	• Insufficient vs. excessive communication • Richness of multiple channels vs. confusion about which channels to use when. • Focusing on message production versus impact of the communication
Processing information	Efficiency, cost, accuracy, precision, error rate, rework rate, downtime, vulnerability	• Cost and efficiency vs. completeness and detail. • Focusing on processing data vs. producing useful information for task or decision needs
Thinking	Clarity, originality, insight, flexibility, focus	• Maintaining control versus freedom to think • Focus vs. out-of-the-box thinking
Representing reality	Completeness, accuracy, objectivity, clarity. bias, omissions, confounding	• Precision/ granularity vs. big picture issues • Objective data that can collected automatically vs. including subjective information.
Providing information	Information quality, completeness, usefulness, timeliness, accuracy, understandability, source, comparability, bias	• Informing vs. under- or over- informing • Understandability vs. information overload • Predefined vs. ad hoc information • Emphasizing information transfer vs. human abilities to perceive and process information

3.5 Common sub-facets

Table 5 illustrates how most facets bring sub-facets that are often useful when exploring a facet of work in depth. As with facets, sub-facets are activities or groups of activities. Thus, people discussing the facet *making decisions* might start by identifying and discussing consequential decisions in the relevant situation. They might build on that by looking at sub-facets, i.e., focusing on how problems are defined, how criteria are identified, how relevant information is gathered, and so on. That type of attention to facets of work does not appear in typical descriptions of SA&D, BPM, and EM.

Table 5. Sub-facets related to each facet

Facet	Related sub-facets
Making decisions	Defining the problem; identifying criteria for making the decision; gathering relevant information; analyzing the information; defining alternatives; selecting among alternatives; explaining the decision to stakeholders.
Communicating	Formulating the message; conveying the message; receiving the message; verifying that the message was received and understood.
Processing information	Capturing, transmitting, storing, retrieving, manipulating, displaying, and/or deleting data/information.
Thinking	Identifying the topic, visualizing the situation; identifying issues or concerns; considering knowledge or evidence; considering alternatives; iterating
Representing reality	Identifying key aspects of reality that matter in the situation at hand; identifying ways to represent those aspects of reality; selecting the most acceptable representation in terms of usefulness versus cost; capturing and manipulating relevant information to produce the desired representation of reality.
Providing information	Identifying alternative ways to provide information that might be needed; identifying the most appropriate way to provide required information; packaging information for conveyance to the user; transmitting and/or displaying the information.

3.6 Open-ended questions and follow-up questions

For each of the first six facets, Table 6 identifies typical open-ended questions that could be considered when discussing requirements or when evaluating the likely success of a proposed system or system improvement. Table 6 also identifies several typical follow-on questions that could be used to look at specific facets in more depth.

The questions in Table 6 are straightforward and can be pursued without deep theoretical knowledge in each area. Many surely are pursued in some way in current systems analysis efforts. A checklist form of questions such as those in Table 6 could support research by highlighting issues that were pursued or ignored in real settings.

Table 6. Open-ended questions related to different facets of work

Facet	Open-ended questions for starting a discussion, plus follow-on questions
Making decisions	Open-ended question: How do the available methods and information help in making important decisions? ... Follow-on questions: What decisions are made with incomplete, inaccurate, or outdated methods or information? How might better methods or information help in making decisions?

Communi-cating	Open-ended question: In what ways is communication effective or ineffective in this situation? ... Follow-on questions: Where and how does ineffective communication degrade performance or cause problems interpersonal issues? Where is information garbled in communication?
Processing information	Open-ended question: Are there situations where capturing, transmitting, storing, retrieving, displaying, manipulating or deleting important information is ineffective, error-prone, or costly in time and effort? ... Follow-on questions: What information is captured or transmitted inaccurately? What information is difficult to store or retrieve? What information would be more useful if it could be refined or displayed better?
Thinking	Open-ended question: Are there situations where people seem not to have enough time or liberty to think carefully about what needs to be done? ... Follow-on questions: Does performance pressure or attention to minor details drive out the ability to think about important issues? Are people frustrated about how the work setting affects their ability to think creatively?
Representing reality	Open-ended question: What are examples of important information that is not represented well or is never collected? ... Follow-on questions: Is information recorded or presented in a way that requires manual workarounds to figure out what is going on? Are corporate information sources as accurate or timely as information from spreadsheets?
Providing information	Open-ended question: How does the available information succeed or fail in helping managers understand what is going on? ... Follow-on questions: How do managers figure out what is going on? Through standard information systems? Through spreadsheets? Through face-to-face discussions? What important information is unavailable?

4 Appearance of facets of work in a case study

A test of the practical value of facets of work is whether the facets of work appear in non-trivial ways in real world situations. This section uses a case study called "The Update: Why Doctors Hate Their Computers" (Gawande, 2018) as an example. The author of the case study, a prominent surgeon, describes experience related to the $1.6 billion implementation of the EPIC electronic medical records (EMR) system in Partners HealthCare, which has 70,000 employees, 12 hospitals, and hundreds of clinics in New England, USA. Gawande's account recognizes the value of the EMR system but as implied by its title does not support aspirational views of EMR as providing the best possible patient information, eliminating vulnerabilities of paper, facilitating communication, assuring consistency, and improving evaluation of treatments.

Table 7 uses quotations from the case to illustrate that the first six of the 18 facets were mentioned, either directly or indirectly, by a surgeon who wrote the case study to describe what he saw as the essence of a real world situation that mattered greatly to him and his colleagues. A complete table in the workshop paper mentioned earlier showed that 14 of the 18 facets appeared in the case. The significance of finding quotations for 14 of 18 facets should not be exaggerated, but notice how typical ap-

proaches to SA&D, BPM, and EM could have missed many issues that a surgeon viewed as important for understanding the situation.

Table 7. Quotations related to facets of work, from Gawande's (2018) EMR case study

Facet	Quotations related to this facet
Making decisions	"Perhaps a computer could have alerted me to the possibility of a genetic disorder in [a patient], based on his history of skin lesions and the finding of high calcium." (p. 73)
Communi-cating	[Her] "in Basket" … had become .. "clogged to the point of dysfunction. There are messages from patients, messages containing lab and radiology results, messages from colleagues, messages from administrators, automated messages about not responding to previous messages. "All the letters that come from the subspecialists, I can't read ninety per cent of them. So I glance at the patient's name, and, if it's someone that I was worried about, I'll read that," she said. The rest she deletes, unread." (p. 66)
Processing information	"Ordering a mammogram used to be one click," she said. "Now I spend three extra clicks to put in a diagnosis. When I do a Pap smear, I have eleven clicks. It's 'Oh, who did it?' Why not, by default, think that *I* did it?" She was almost shouting now. "I'm the one putting the order in. Why is it asking me what date, if the patient is in the office today? When do you think this actually happened? It is incredible!" (p. 65)
Thinking	"Our systems are forever generating alerts about possible connections—to the point of signal fatigue. Just ordering medications and lab tests triggers dozens of alerts each day, most of them irrelevant, and all in need of human reviewing and sorting." (p. 73)
Representing reality	A doctor "manages a large number of addiction patients and has learned how to use a list to track how they are doing as a group, something she could never have done on her own." The EMR supports new ways to "identify patients who have been on opioids for more than three months in order to provide outreach and reduce the risk of overdose." (p. 66)
Providing information	"I could now remotely check the vital signs of my patients recovering from surgery in the hospital. With two clicks, I could look up patient results from outside institutions that use Epic, as many now do." (p. 64)

5 Conclusion: Bringing Facets of Work into Requirements Determination and SA&D

This conceptual contribution was motivated by the belief that common techniques for requirements determination and SA&D typically downplay or ignore a great deal of knowledge developed over decades by hundreds or even thousands of business and organizational researchers. Bypassing systematic consideration of business, social, and conceptual issues that are relevant to work system efficiency and effectiveness surely does not contribute to system success. Various approaches to applying ideas

illustrated in Tables 1 through 6 could make more of that knowledge available for collaboration between practitioners, managers, and IT professionals.

Facets of work is a highly adaptable idea that can be used without disrupting the benefits of existing methods. It can be used in conjunction with existing SA&D methods by simply adding new questions about facets of work at whatever level would likely generate insights quickly. Non-experts in any given facet would apply the relevant knowledge less precisely and less deeply than experts, but visibility of those topics would be more beneficial than ignoring them.

Here is a simple, lightweight approach that an individual or a group could use in these ideas with the help of a web-based tool, a PowerPoint presentation, or just a set of checklists:

- Select one or several facets to consider
- For each of those facets:
  - Briefly consider open-ended questions such as those in Table 6.
  - If desired, look ideas for that facet from Tables 3, 4, and 5 to help with relevant concepts, evaluation criteria, trade-offs, and sub- facets.
  - Discuss, take notes, or obtain relevant information
- Iterate for any other facets that might seem important in the situation at hand.

That type of approach is in the spirit of techniques in the upper left-hand corner of the design space in Figure 1, i.e., focusing mostly on establishing basic understandings, supporting better communication between stakeholders, and assuring that agreements and goals are clear before moving to rigorous documentation, specification of software functionality, and software development.

Facets of work might be incorporated into agile development without undermining its spirit of avoiding excessive analysis and documentation. Identifying and discussing relevant facets of work near the beginning of a project would help in maintaining coherence by keeping the related issues visible during the project. Looking at the same topics later in the project might help in visualizing whether production to date and completion of the current project backlog seem likely to generate desired results.

The idea of facets of work could also be incorporated into empirical research about how requirements determination and SA&D are performed in practice. The facets provide the basis of simple checklists that could be used to analyze meeting notes, formal documentation, recordings of interviews, and other indications of what was or was not considered during the project. Analysis of that type of information would provide empirical evidence about whether systematic consideration of *facets of work* in IS development projects is likely to lead to better business outcomes.

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