

# FIVE PERSPECTIVES ON INNOVATION

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## ABSTRACT

Innovation typically involves cross-divisional, -functional, and -disciplinary collaboration when performed in large organizations. This paper explores five different concepts of innovation. The aim is investigate how different people involved in innovation conceptualize innovation in an effort to reduce misunderstandings and thereby improve innovation processes. A series of interviews was conducted on how innovators understand what they do. We identified five perspectives: an organizational, a technology, a user/consumer, an idea/concept, and a participant model. These mental models then can be used to start to bridge the different academic traditions in the innovation literature. They can also to help innovation teams make sense of their struggles with the aim to improve innovation practice.

## INTRODUCTION

Innovation, the introduction of new products, services, or experiences to the market, is generally recognized as a driver for growth in business. It typically involves different disciplines and functions within the company, as the complexity of products demands a broad range of knowledge. However, cross-functional collaboration presents a number of challenges (Edmondson & Nemhardt, 2009; Bechky 2003). Members of different disciplines may hold different mental

models of innovation, which can lead to frictions and misunderstandings.

Mental Models are people's representations of the world based on experiences and assumptions. The concept originated from cognitive psychology ( Craik 1943; Johnson-Laird 1983). It was adapted and later used heavily in the field of Human Factors Engineering as conceptions about how systems work (see Nielsen 1990, Moray 1996, and Rutherford 1989), which since the 1990s has largely been incorporated

into the field of Human-Computer Interaction (HCI). It became an explanatory device for making sense of usability problems: If a system fails to match the user's mental model of it then there will be a breakdown. When a system matches the mental model of the person using it there should be fewer if any problems. Therefore it is thought that in order to build computer programs, systems, and especially interfaces system developers should aim to match the mental model of those using the system. The concept of mental models is a powerful one, bringing with it the baggage of cognitive psychology, but we do not import this wholesale, rather we invoke it as a metaphor useful in explaining how people understand their work.

The motivation for this study was to apply the metaphor of mental models to understand how those involved in innovation conceptualise what they do, and whether the concept could help to understand when and why problems arise. We argue that if those that participate in innovation had a clear and shared understanding of how their work contributed to the overall project or the role they played in a system, then the in-

novation process as a whole would produce fewer problems and delays. I.e. if people understood clearly what was to be achieved and how to achieve it, they would be able to do it more effectively and efficiently. The way that this information can be gathered is through the process of reflection-on-action (Schön 1983) in the interview process.

Initial gathering of information to ground the research design was based on internal documents available freely on the organizational intranet, as well as informal conversations and requests for documents on the subject as part of participatory ethnographic observation inside of a research & development organization in a group of researchers focusing on user experience. This initial documentation period lasted approximately 10 weeks.

During this initial period a number of concepts of innovation were mentioned that needed explanation and investigation in the literature such as open innovation (Chesborough 2003), Blue Ocean strategy (Kim and Mauborgne 2005), and the general ideas of innovation (Van de Ven 1986, Garcia 2001). The concepts of open innovation and Blue Ocean strategy, are used frequently by those inside of the organization, and going back to the original literature it became clear that the organization aspired to many of these kinds of things and that some programs had been put into place to promote it, though it was not readily clear whether those initiatives were successful. Concepts such as roadmap, adjacent, and breakaway innovation were also used frequently though their use was often not distinct and there was no clear shared understanding. From Van de Ven and Garcia it became clear that even in the literature there is a not a clear consensus in many basic definitions of innovation, bringing at least that aspect in-line with the current status inside of the target organization. Based on this a broad and open perspective and approach was taken to the study.

## METHODOLOGY

There were several important factors in this initial period that influenced experimental design. First there was an accepted model of innovation and concordant processes and methods, yet it was also clear that these processes and methods were not always followed. This phenom-

enon needed more than just questionnaires; it would require visits to sites as well as deeper interactions.

Twenty-two interviews were conducted in all divisions of the organization. The interviews were semi-structured and typically lasted for one hour. The questions focused on innovation and what innovators conceived of it and how it is carried out. During the interview participants were supplied with a large (A3) piece of paper on which they could sketch their innovation process at the appropriate moments. When the participant did not care to sketch the researcher often would take up the pen and collaboratively sketch what they described in order to give focus to discussions and when different things happen at different times.

## INTERVIEW GUIDELINE

Typical introduction and disclosure started each interview along with the start of an audio recording. Given the approach broad and open wording was used around the following key questions:

- “What comes to mind when the word innovation is mentioned?”
- “Who do you involve in your innovation process?”
- “At what points do you involve them?”
- “In what way do you participate in innovation as part of your job?”
- “What percentage of your time do you think is focused on innovation?” “How do you feel about that?”
- “Do you follow a fixed or semi-fixed program of activities for innovation?”
- “Think of a project. What is the name of that project? Could you sketch or describe the process you followed, and relate it the program you just talked about?”
- “If you were in charge of innovation, what would you do differently, if anything?”

## SAMPLE

It was decided that a general, organization-wide understanding of what innovation is and how it is practiced would be the most interesting. One of the main reasons for this focus was that the owners and promulgators of the officially recognized innovation process did not only reside inside the research and development (R&D) organization, therefore a study that reached beyond those barriers was called for. The second reason for choosing an organization-wide focus for this initial study was that

there was already preliminary evidence of cross-divisional, -function, and -disciplinary issues. Cross-disciplinary issues were quite prominent and an early finding was the great disparity between how people were studied and their needs were incorporated into the process of innovation.

Recruiting was undertaken using a snowball system starting with existing contacts who were willing to refer others. A conscious effort was made to reach out to all the major business sectors of the organizations as well as the various corporate divisions involved in innovation. Generally prospective participants were invited via email with a short introduction to what the interview would be about. The researcher then travelled to their location and the interview was conducted in a meeting room or the participant's private office.

## PARTICIPANTS

Business Sector	11
R&D	7
Design	4

Total # of participants: 22

The following table gives an overview of organizational position of the participants.

C-level participants: 2	Director-level participants: 6
Participants in Corporate HQ: 1	Non-permanent participants: 2
Approx average years of service: 11	

*\*Note that some participants fit into 2 categories, i.e. one could be a non-permanent employee in design*

The interviews lasted on average 55 minutes from start to finish, and were audio recorded. Interviews were then transcribed verbatim, except where the participant repeated herself. Transcriptions also included contextual comments such as [pointing to sketch] [repeats] [both laugh] [pause].

## ANALYSIS

The target organization, especially in the research and development organization was especially interested in reflecting on their work practices and improvement, calling for a participatory approach. This along with the large amount of data gathered and the desired open approach led to an analysis that consisted of three distinct phases: 1) Participatory group

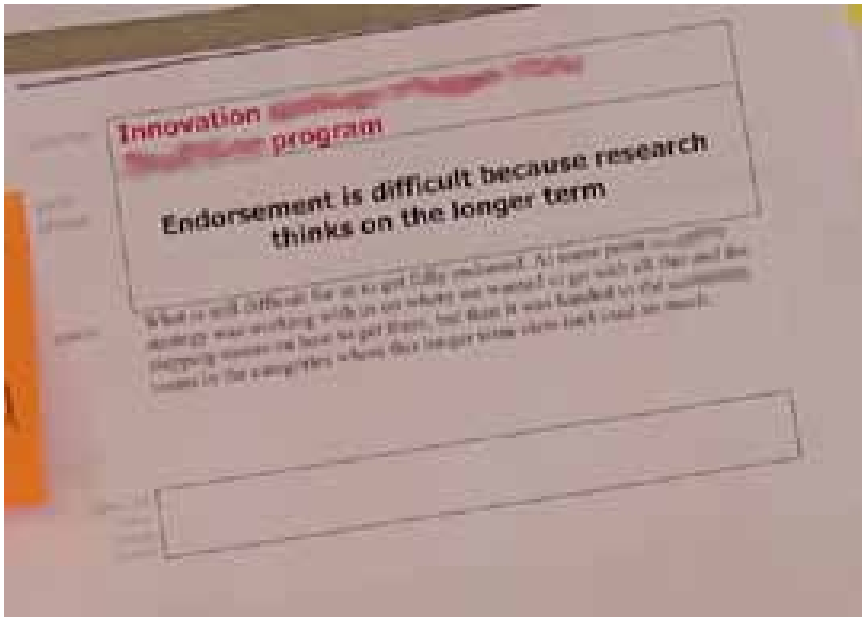


Figure 1 This is a statement card before it is filled in digitally, then printed out and brought to analysis sessions.

affinity analysis; 2) systemizing unification of group findings; and 3) Iterative analysis of affinities and axial coding (looking back into transcripts for more examples of a particular finding). The participatory group analysis is based largely on Stappers (2008) Concept and Conceptualization, which is a grounded method with participatory elements.

A group of nine researchers and interns from the target organization versed in working in user-centered research was asked to participate in the analysis, which consisted of some individual preparation and a group analysis session. As part of the individual preparation, each researcher was given 1-2 transcripts to read the transcript in order to familiarize themselves with the contents and to highlight important passages. From those highlighted passages the researchers were then asked to select between 6-10 passages to put into cards. Each card contained both the text of the original quote, the title and organizational unit of the person interviewed, as well as a paraphrase/initial interpretation of the quote. There was space on the card for comments and reactions. At the group some researchers were asked to present a few of their cards to each other then the cards were passed around so that each person could have at least a passing familiarity with each card as well as to comment on individual cards should they desire to. Affinities of cards were then developed via presenta-

tion and negotiation. Each affinity was placed on a table and rearranged to represent the kind of relationship between the affinities.

After all the cards were placed, affinities that contained many cards were unpacked and further differentiated into subcategories. Relationships between the groups were then explicitly mapped and defined. Each participant individually could then comment on any part of the results including individual cards, groups, and relations. This resulted in a diagram shown in figure 2.



Figure 2 The pink notes show affinity names, the yellow relations between affinities and blue are comments from research team members about that affinity

Each group session lasted for approximately 2 hours total and analysis participants reported spending between 1.5-2.5 hours in advance of the session in preparation. Four separate analysis groups covered all the interview transcripts.

The researchers then consolidated affinity results across all analysis sessions, further merging affinity groupings as appropriate. The comments and some of the relations were removed where there was overlap.

Next was a series of iterative (re-)evaluations of the statement card data collection where all the relations were removed and the affinities were created afresh or affinities were parsed into different subgroups and meta-groups. Diagrams and relations between the groups were undertaken at various points. It was at this point that axial coding took place, where additional data was looked for on certain topics in the existing data set as well as in ethnographic field notes and codes. Figure 3 is an example of an emerging diagram of topics.

## FINDINGS OVERVIEW

All participants were passionate about the subject of innovation. In all cases participants were able to express both positive and negative aspects of the innovation practice inside the organization, though most tended to skew more heavily in one direction or another. This

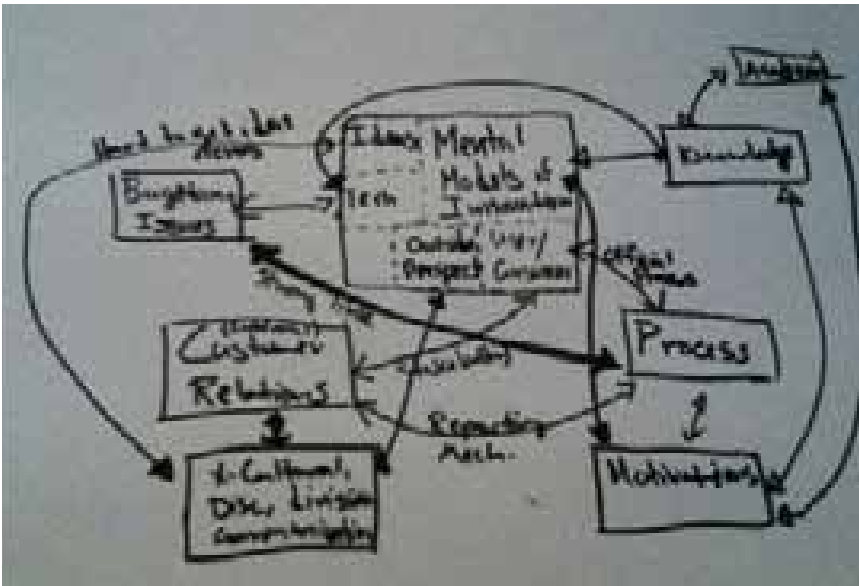


Figure 3—this is an intermediate step showing a large set of affinities grouped in the center with other around it with their relations

skewing and sometimes rather strong statement can be attributed to the participants' eagerness to excel in the area of innovation, and to see their organizations excel as well. All of them considered innovation to be the main focus of their work, no matter their job description. In about 50% of the interviews participants sketched out their process, in other cases they described it verbally.

Most interviewees struggled with what they perceived to be a less than optimal ways of working, inefficiency or sometimes frustration. When confronted with this one manager said "This has to do with their passion for innovation." I.e. people care so much about innovation, and see it as so much of a priority that they desire to see it be done as well as it can be. The passion for the subject is noted above as well as the fact that there was no shortage of people who were willing to give up an hour of their working week to speak on the subject.

A large number of issues were identified as strongly affecting innovation including cross-divisional work, cross-disciplinary work, inefficiency of business processes, concerns about competencies, and budgetary processes. In order to bring coherence to the findings the metaphor of mental was invoked and a natural delineation of data emerged into five difference perspectives.

A large portion of the cards generated in the analysis consisted of groupings of statements that proposed various mental models of innovation. No one perspec-

tive emerged, and there was some data that suggested that those interviewed thought there is "no one way to innovate" and that the way people innovate must be tailored to the context of the project. While this may be so, it is clear that there are some clear foci to the perspectives emerging from the data. There are no sharp lines between perspectives,

but rather relations between them as they are each connected. The perspectives are: organizational, technology, user/consumer, concept/idea, and innovator.

In this way the organizational focus clearly shows the top-down, organization-as-a-whole nature, the three middle models acts as approaches for either a top-down or a bottom-up focus, and then the innovator focus as bottom-up. Each focus will be presented first with a short summary of the findings, then a numbered list of the findings that fit into that perspective. In this section (as well as above) a statement in quotation marks in *italics* represent a direct quote from a participant and a statement in standard typeface represents a close paraphrase of several participants combined used for clarity and space limitations. A statement in a numbered list without any quotation marks is our interpretation of the data.

#### INNOVATOR FOCUS

The essential questions of the innovator focus were: "What must I do to innovate? How can I push my project forward? Where will I focus my innovation work?" This perspective is decision & action oriented. Innovators are hungry



Figure 4 The five perspectives of innovation

for this kind of information, and are not finding it in a general form in the workplace. One participant even expressed his doubt as to whether can be one approach, *"I don't think there can, or ought to be one approach."*

The findings were condensed into the following statements, of which 1-4 refer to those pursuing innovation inside of the R&D division.

1. For those doing innovation inside of R&D: *"I am irritated... it is hard to access information, and even once you have it we don't have the proper background to use it well."* (see 2)
2. *"It's hard for me to make decisions about innovation because often it's not clear what innovation really is, inside of a project there are too many factors to consider such as user needs, business needs, market opportunities, open innovation partners, there is no one expert on innovation."* *"I'm not trained on many if not all of these things as they are outside my area of expertise."*
3. Innovators liked to have some control over what they work on. When asked about what they would do differently some responses were that they would introduce *"20% time [for innovative projects], a return to the good old days when they [corporate]... would drop a bag of money on us each year."* I.e. more freedom to decide research direction and more budgetary independence from business. Another researcher proudly remarked that he has, *"been involved in strategic discussions"* about where a product category was going.
4. R&D personnel said that in order to get an innovation *"to land inside of a business"* unit it had to be within already developed business channels. *"In some cases I will tend to focus my efforts in established places, and in other cases I want the business to be bold and step outside."* At the same time one researcher said that *"if I'm developing something that fits into two separate places in the organization and could benefit them both I would never try to sell it to both of them, because one would say, 'let the other pay for it.'"*
5. *"It's hard to work with people from other perspectives, we don't always value each other... We talk about depending on each other... there used to be a lot of talk about acting like one organization... but we don't all feel like*

*one unified organization."*

6. *"I am managing innovation and I wish there were much more understanding of different ways of working, there's so much cultural inertia, I want to change the culture and mindset instead of just processes and procedures."*
7. *"I don't think we focus enough on breakaway innovation."* *"People in [a certain section of the organization] don't seem to be concerned about long-term innovation [while we in this part are concerned more about it]."*
8. *"I'm frustrated with [the process that I'm required to do for funding and budgetary approvals]. It feels like a waste of time."* *"I once calculated how much time we spend on [this process] multiplying that with our annual salaries it turns out to be a lot!"*

The innovator focus revealed individual motivations for innovation that were almost always associated with a sense of adventure (*"Let's try this!"*), challenge (*"Can this be done?"*), and scientific curiosity (*"what would happen if...?"*). This focus also addressed people's frustrations when they could not do what they perceived as their best work. These frustrations were related to the organizational focus as well as the user/consumer focus. From the organizational focus, processes led to frustration when they were seen as an impediment rather than an enabler of work. When budget decisions or selection processes were experienced as opaque and arbitrary, this also led to frustration. Nevertheless it is clear that the innovator-focused model can be of help to both the innovators and those managing them (see statement #6 above for example). Some innovators were not totally comfortable with the idea of connecting to the user/consumer perspective. This discomfort was on the part of highly trained people who are specialized in fields not traditionally focused directly on human needs. In this case the user/consumer perspective introduced an *"unclear selection criterion"* into the innovation process as one researcher put it, which to this person made all of a range of choices equally good.

It should be noted that statement seven in this focus was quite universal. Everyone interviewed was concerned about ensuring sufficient time and resources for long-term, breakaway, or blue ocean innovation. Everyone shared this same

concern irrespective of their position or division.

The innovator perspective is about what the participant can do, what are the actions they can take, what kinds of decisions they must make in their own work. This relates to what they think about innovation for their own project or ideas (this connects to ideas/concepts in general and to other people's ideas/concepts), how they fit into the organization (they're not particularly happy with constraints), what processes they must use (they think they are inefficient), how they feel about the organization (where they fit, how they relate to other parts of it).

#### CONCEPT/IDEA

This second type is focused on the concept/idea focus itself. The concept/idea was often conceived of as having a life of its own, with particular properties pertaining to it. In this case the property of newness was seen as primary to innovation. When talking about how ideas start and turn into innovation, the metaphors of size, speed, and luminosity were called on as properties. If an idea was described as *"gaining traction,"* speeding up, getting bigger or brighter, it was seen as moving forward on an imagined path towards completion. This imaginary path that a concept or idea takes from a vague starting state to market launch is a very common understanding of how innovation works.

The data for this focus fall into the following affinities:

1. Some people consider originality or newness to be primary. *"The next generation of [a product category]... that doesn't count of innovation, I'm talking about something really new. We don't do that enough (connecting to the innovator focus point 7)."*
2. *"We are starting to understand that innovation doesn't have to come from technology."* *"Innovation can come from not changing the product at all but changing the way we package or sell it, like the way Dove totally changed the way they sell their product."*
3. *"I think that ideas can come from anywhere, make room for them to bubble up from anywhere."* There is a continuing rumor that a researcher first thought of the concept that led to a large well-known product category while on the toilet. People mention ideas coming from family members.
4. *"I see ideas all over; the people who*

have them don't know what other people are also doing with the same/similar ideas." They further lament, "if ONLY we had a way of knowing what people are doing!"

5. In response to how does an innovation move to market one participant tellingly said, "Once an idea has enough people working on it or believing, it gains momentum, people start coming to the idea, then it will happen."

During each of the sessions participants had the opportunity to sketch their process. A number of different conceptions of how their innovation process worked came forth from these drawings. These drawings were without fail idealizations of actual events or an abstraction of their process. This kind of sketch visualizes the concept moving along an imaginary line or through numbered steps. The drawings produced were in line with many diagrams of innovation or design processes both in academic literature as well as those that are used in practice (See von Hippel 1976, or Sharp et al 2007 for several examples). E.g. from the world of software development, the waterfall model would be prototypical, see figure below and <http://www.jknichols.co.uk/SL2.html> for numerous examples. Participants envisioned an idea or concept as progressing in a certain way or being stopped and thrown out.

The concept/idea focus also relates to the technology focus. A technology such as an algorithm, a patent, or a standard is all examples of an idea or concept. They are also seen as independent of people in some way.

The innovator focus is close to the idea/concept focus in several ways. First of all even though we often conceptualize a concept as independent of people, especially as it progresses towards market launch, although of course it is only through the efforts of participants that such things can happen. This also links to the ideas of getting the right people to work on an idea, getting champions of that idea etc (for a review of this process see Howell and Boies 2004).

Some participants found that the newly introduced social media platform was starting to fulfil this desire to some extent. Some suggested other ways of dealing with efforts by other companies such as Tata or IBM which are similar to that described by Aiken & Carlisle (1992) would further fill the desire stated. This

connects again to the innovator perspective in that it relies on innovators to drive a preliminary participatory process in order to produce more solid concepts to build upon.

#### USER/CONSUMER

The user/consumer focus relates to more traditional notions of participatory design and innovation. The involvement of people who will ultimately use or be served by a particular innovation was the focus of this mental model of innovation. If the process was centered on users innovation was described as starting with defining and understanding a human need and then a solution would be tailored to that approach. This could be done from several disciplinary points of view, though the two most common were marketing and design. In this focus innovation was not seen as ending at launch, but rather launch was just the more widespread opportunity to gather feedback about the innovation. The feedback could be used to adjust either the innovation itself or the way it is understood/marketed or both. This model has recently been challenged by Norman's 2009 statement that technology always comes first. However, whether this is true or not is still a matter of debate (See Nussbaum 2009).

There are a number of different approaches to understanding human needs and desires and then profitably creating something that responds to that need/desire/problem. The data in this focus were summarised in the following statements:

1. "I use a user-centered design approach, using such tools as cultural probes, observation, ethnography, getting into the head of the user via similar experience."
2. "In [our part of the organization] we analyze larger societal trends such as aging population or the types of things happening in emerging markets."
3. "What we aspire to do is anticipate needs before they arise by proposing solutions to latent needs."
4. "We understand people in a human way and not just as units of consumption." "We look at life stage transitions and see if there are unmet needs in some of these places."
5. "I see society's future as all about solution-centered design: start with an identified problem, define that problem more precisely, then empowering

one person to be in charge of solving it, and then check to make sure you actually solved it."

6. "We use so-called value propositions and/or insights in a formal way prescribed by [one part of the organization]."

There seemed to be strong connections with the marketing research, UCD, and various kinds of analysis for understanding the human experience and needs. UCD and marketing research tended to not do particularly well with breakthrough innovation, but this was balanced by multiple approaches that spanned outside of these typical domains. This connects with the organizational perspective in terms of some approaches that were officially accepted and in some cases obligatory. The user/consumer perspective connected with the technological focus as it is seen as a kind of filtering mechanism for those ideas research and development (see #2 below).

#### TECHNOLOGY

The Technology focus dealt with technologies, how they were developed, protected through patents, and sometimes put into standards. Other times technology was developed as a kind of shotgun approach, taking a wide swath of technologies with the understanding that some of them would win in the marketplace. The technology focus interacts heavily with both the organizational focus and the idea/concept focus. The use of the word 'we' below refers to the participant's particular division.

1. "What we do, or what we want to at least is build up expertise in a field of technology, be a key player around that area, sometimes this is an explicit choice looking at where the market may be going sometimes, but not other times."
2. "We use a kind of shotgun approach: develop a whole lot of technology, patent and protect it and then let the market filter it." "We hope, and push for the technology we develop to become part of market accepted standards"
3. "We see technology as enabler, it is what makes other things possible, and it shouldn't change too often."
4. "We start with technology and when it's proven then you can start adding in the other things, gathering use requirements, and user input."
5. One c-level executive said, "We still

*believe that the technological possibilities can inspire innovation.”*

6. *“I see that teams often decide first on functions and technical specs before other considerations, even marketers and product managers do this... as opposed to involving users/consumers, their needs and desires, into the process”*

During the discussions in the analysis phase, the research team first considered lumping technology into the concept/idea focus and/or the organizational focus because it related directly into those to areas. However, it was decided that it needed to stand on its own. The technology focus is related to the organizational focus because so often the legal and intellectual property departments have a strong hold on many different processes. It is related to the concept/idea focus as the focus is on the thing itself and away from the people who create and use it. This was one area that people took so for granted that they did not talk about it extensively in interviews. During informal conversations noted in ethnographic field journals the first author noted how strongly technology influenced their work, especially how intellectual property issues played a large role in what they did.

#### ORGANIZATIONAL

The organizational focus of innovation is about management, business process, and organizational structure of innovation. This focus is process oriented and often presents clean graphic representations of how innovation ought to happen. Often these processes are mandated, stage-gated, and controlled. The target organization, considers that innovation is what will keep them competitive and fuel growth but surprisingly in many companies there is no one, unified way of looking at innovation from the fuzzy front end to product launch and feeding back the results of product purchase and usage back into the loop. Another surprise in this area of focus was that there was no a unified business process that similarly spanned the length of innovation.

For the organizational focus two major categories were identified: Process & Budgets. Here are the affinity statements for them:

#### Process

1. *“[In one part of the organization] there’s no set program, but we have a*

*series of ambitions.”*

2. A manager speaking of how many projects have used the official process says, *“Not everyone has adopted the official processes to the same level [where it has been given].”*
3. *“Project [pre-] selection is inefficient. It is not always clear how the decisions are made in this process.”*
4. *“We use similar processes to [the function that owns the official process] but because they are not official or exactly the same types of outputs, the result is that our methods [and the results] are not accepted by others.”*
5. *“From where I’m sitting in a director position meant to help ensure processes are being followed there is no way to tell how many projects are going at any given time, and how many products are launched in a year in my area of responsibility.”* I.e. there are not dedicated tools to use to track business processes across the innovation process as a whole.
6. A senior manager of the function that “owned” the official innovation process says, *“The official way of doing is good in theory, but it is possible to follow it to the letter and still miss the purpose of it... We had a project last year where we really followed the spirit of the process, but not all the steps, and the results were superior [then if we had followed each step strictly].”*
7. A more junior manager from the same function *“I’ve seen where a team followed [the official process] exactly got their [outputs of the process a kind of report] and all they did was flip it open to the last page to see if it was [approved].”* I.e. following the official process becomes a kind of box ticking.

#### Budget

1. *“We [as an organization] tend to spend the limited budget on things that have to be done anyway. The business unit believes that since they bring in the money they should control it, but often they spend their budget on short-term things, so there is an ‘innovation tax’ to get around this”*
2. Budgeting for innovation projects comes from various places within the organization, either from corporate (via the “innovation tax”) or from the business units themselves.
3. Stage-gating of innovation budgets was used as means to control which

projects move forward. This was a matter of content of the projects which was judged on a particular scale.

4. Stage-gating was used to make sure the project team followed the official process for innovation.
5. One participant poignantly wondered, *“What if we had one budget for innovation, integrating marketing, design, and R&D?”* I.e. why if innovation is cross-functional, why do we divide budgets by function?
6. *“When we do work for another division we charge them. The intention of it is to bring some kind of financial transparency showing where our money is spent, and if it is well spent. I’m not sure whether we have that transparency, it’s not my speciality, but everyone in my department agrees that the whole thing makes working together more difficult.”*
7. *“They [other divisions of the organization] are of such a high calibre, that having them work with us is justifiably very expensive.”* There are instances when outside contractors have been brought in to work on some projects when internal divisions could have provided the same services. When asked what the rates of the division was the reply universally, even by those whose services were being offered was *“I’m not sure what it is right now”* followed up with *“but I’m sure it’s high.”*

All of the process and most of the budgetary findings fall around an axis with control on one end and independence on the other. The idea of control in an organization via a process is a tempting one for managers, though at least one participant acknowledged he would instead like to change people’s mindset. From the interviews and from the internal document search it is clear there is a propensity for creating processes and programs which are usually mandatory. Making a certain way of working required puts constraints into a creative process. Many participants clearly felt like they were being boxed into certain ways of working and they considered this detrimental to their output. The other effect that was clearly seen was that even when control measures are put into place then people will simply follow them in a way that will satisfy them.

The organizational perspective is connected to the technology focus in that

a specific direction can be specified broadly from upper levels, leaving the details of research and execution to innovators themselves. This perspective is also very strongly connected to the concept/idea focus because the processes and budgetary controls often figure into the idealized paths that are used in the concept/idea focus. As seen previously in figure 4, organizational is at the top, symbolizing how organizational aspects are decided from above.

## DISCUSSION & CONCLUSION

The user/consumer perspective shows that there is some unity between the user-centered design perspective and that of the marketing and marketing research. Surely there are large differences between these communities of practice, but they are still in the service of the same goals embedded into the same perspective. This is the kind of unity that helps transcend boundaries in working as well as research that we propose below.

The innovator perspective has been treated to some extent in the project management literature, but coordinating kind of understanding with the other perspectives could yield additional insight. A more individual approach to the innovator perspective has appeared many times in the business press, but it does not appear to be a well developed scientific research community.

The perspectives presented here are fragmented, and none address the totality of what innovation encompasses. If the reason for studying mental models is to understand how people understand a particular subject in order to improve that subject, then it stands to reason that having a unified perspective may be helpful, but that is beyond the scope of the present work. Some of the possible benefits to research have already been explored and we argue that an improvement in understanding how innovation works can be used in order to better guide one's own innovation practice. In practice having further clarity on the way innovation works can help. We put forth two possible avenues where this may be of service:

1. Seeing past functional/disciplinary/divisional boundaries
2. Appropriate use of model given the situation

An open, explicit discussion of various perspectives of innovation could con-

ceivably help people working across boundaries if there were some organizational acceptance of multiple perspectives. If an innovator has no idea what the official processes are, it may not matter how well it meets a user/consumer need. If a decision maker is clearly in an organizational perspective it won't help to talk about what the innovator herself must do at a decision point. From the organizational focus it may seem like just following the prescribed process is sufficient. In all of these cases there is a need for a shared understanding in order to collaborate in the service of innovation. In future work we plan to explore this communication further via a focus on the material artefacts that are used to communicate across boundaries.

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## REFERENCES

We've included digital object identifier (doi) or direct links to the article for many references for convenience, as we believe that this is a best practice though these are not generally online resources.

Aiken, M., & Carlisle, J. (1992). An automated idea consolidation tool for computer supported cooperative work. *Information & Management*, 23(6), 373-382. doi:10.1016/0378-7206(92)90018-B

Bechky, B. A. (2003). Sharing meaning across occupational communities: The transformation of understanding on a production floor. *Organization Science*, 14(3), 312-330.

Craik, K. J. W. (1967). *The nature of explanation*. CUP Archive.

Edmondson, A. C., & Nembhard, I. M. (2009). Product development and learning in project teams: The challenges are the benefits. *Journal of Product Innovation Management*, 26(2), 123-138. Freeman, C. (1991). Networks of innovators: A synthesis of research issues. *Research Policy*, 20(5), 499-514. doi:10.1016/0048-7333(91)90072-X

Garcia, R., & Calantone, R. (2002). A critical look at technological innovation typology

and innovativeness terminology: a literature review. *Journal of Product Innovation Management*, 19(2), 110-132. doi:10.1111/1540-5885.1920110

Griffin, A., Hauser, J. R., & Griffin, A. (1994). *Integrating R&D and marketing : a review and analysis of the literature*. Massachusetts Institute of Technology (MIT), Sloan School of Management. Retrieved from <http://ideas.repec.org/p/mit/sloanp/2533.html>

Hippel, E. (1976). The dominant role of users in the scientific instrument innovation process. *Research Policy*, 5(3), 212-239. doi:10.1016/0048-7333(76)90028-7

Howell, J. M., & Boies, K. (2004). Champions of technological innovation: The influence of contextual knowledge, role orientation, idea generation, and idea promotion on champion emergence. *The Leadership Quarterly*, 15(1), 123-143. doi:10.1016/j.leaqua.2003.12.008

Johnson-Laird, P. N. (1986). *Mental Models: Towards a Cognitive Science of Language, Inference and Consciousness*. Harvard University Press.

Kim, W. C., & Mauborgne, R. (2005). *Blue ocean strategy: how to create uncontested market space and make the competition irrelevant*. Harvard Business Press.

Leifer, R (2000). *Radical innovation: how mature companies can outsmart upstarts*. Harvard Business Press.

Norman, D. (2009). *Technology First, Needs Last*. Retrieved October 8, 2010, from [http://www.jnd.org/dn.mss/technology\\_first\\_needs\\_last.html](http://www.jnd.org/dn.mss/technology_first_needs_last.html)

Nussbaum, B. (2009). *Technology Vs. Design--What is the Source of Innovation?* - BusinessWeek. *Businessweek.com*. Retrieved November 12, 2010, from [http://www.businessweek.com/innovate/NussbaumOnDesign/archives/2009/12/technology\\_vs\\_c.html](http://www.businessweek.com/innovate/NussbaumOnDesign/archives/2009/12/technology_vs_c.html)

Schön, D. A. (1983). *The reflective practitioner: how professionals think in action*. Basic Books.

Stappers, P. J. (2009). *Methods and techniques for the conceptual phase of design*. Retrieved November 12, 2010, from <http://www.io.tudelft.nl/live/pagina.jsp?id=aba88d6a-95e9-4676-8124-9efffc6957a8&lang=en>

Sharp, Rogers, & Preece (2007). *Interaction Design: Beyond Human-Computer Interaction* (2nd ed.). Wiley.

Van de Ven, A. H. (1986). Central Problems in the Management of Innovation. *MANAGEMENT SCIENCE*, 32(5), 590-607. doi:10.1287/mnsc.32.5.590