UNINTENDED CONSEQUENCES OF INNOVATIONS

understanding complexity in a social system

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An MFA thesis document presented in partial fulfilment of the requirement for the degree MFA in Visual Communication Design at Herron School of Art and Design, Indiana University 2011

by
Juhi Singh

Approved by Masters' Thesis Committee:

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Lee Vander Kooi, Thesis Committee Chair,
Assistant Professor, Visual Communication Design

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Pamela Napier, Thesis Committee secondary member,
Visiting Assistant Professor, Visual Communication Design

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dedicated to Papa, Mummy, Tanu & Vidit

acknowledgements

I owe my deepest gratitude to my Thesis Committee Chair, Lee Vander Kooi, for his continuous support and patience. This thesis would not have been possible without Pamela Napier as the Secondary Committee member and Christopher Vice as the Tertiary Committee Member. Their encouragement has always helped me to stay motivated towards my thesis. I also want to thank all my colleagues in the MFA Visual Communication Design Program. Their help on various occasions is gratefully acknowledged. Lastly, I offer my regards to my family and friends who supported me in any respect during the completion of the project.

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abstract

The complexity of a social system-multilayered interactions between people and systems- often results in surprising interactions and unintended consequences. Research shows that this complexity can be better understood if we look for patterns, connections and causal relationships in a social system and that can lead us to planning for a knowable future. Since the corporate sector is accountable for two-thirds of global trade they are more capable of handling the complex issues that our planet faces today- declining economy, melting icebergs, etc., they play a critical role in solving these challenges while building their businesses. Since our mental resources for visual invention, as embodied in visual mental imagery, were originally better adapted for perceiving and acting on the immediate present, than for imagining the future, the purpose here is the developing of a visual tool to understand complexity in a social system.

problem statement

How might a visual tool enable collaborative working teams within an organization to identify patterns in a complex social system?

Definitions of terms

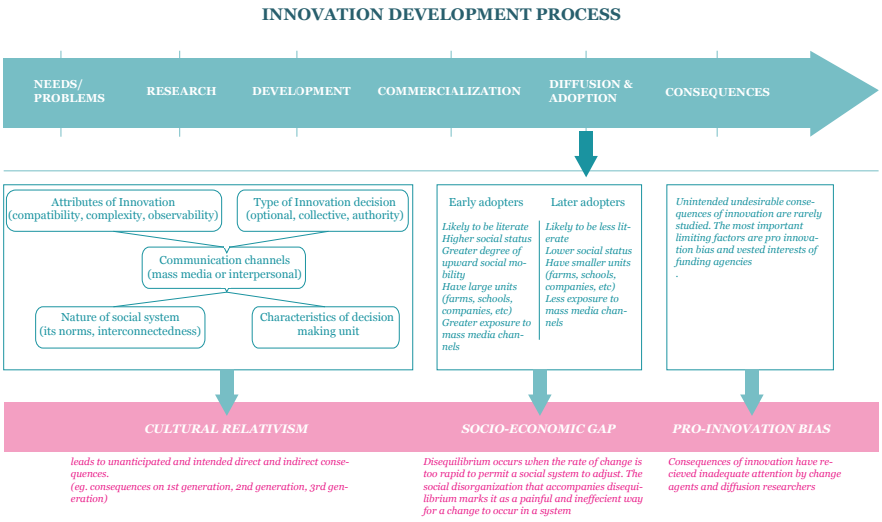
visual tool:	*a tool that helps to visualize the whole problem while working on individual parts*
collaboration:	*a recursive process where two or more people work together in an intersection of common goals by sharing knowledge, learning and building consensus*
working teams:	*fundamental learning units in an organization; people who need one another to produce an outcome*
patterns:	*a type of theme of recurring events or causal relationships, example, social, environmental, financial, etc.*
complex system:	*A system composed of interconnected parts that as a whole exhibits one or more properties not obvious from the properties of individual parts*
social system:	*A system consisting of people interacting with one another*

Sub questions

1. In what ways can a visual tool help to visualize the whole problem while working on individual parts?
2. How can visualization help people working together identify types of themes of recurring events or causal relationships that are interconnected in a social system?
3. In what ways can people working together engage with visualization of patterns?
4. How can pattern identification help the fundamental learning units produce appropriate outcomes?

introduction

An innovation is an idea, practice, or object that is perceived as new by an individual or other unit of adoption. It matters little, so far as human behavior is concerned, whether or not an idea is objectively new as measured by the lapse of time since its first use or discovery. The perceived newness of the idea for the individual determines his or her reaction to it[1]. If the idea seems new to the individual, it is an innovation. Diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system[2]. Consequences are the changes that occur to an individual or to a social system as a result of the adoption or rejection of an innovation. Invention and diffusion are but means to an ultimate end: the consequences of adoption of an innovation[3].



INNOVATION DEVELOPMENT PROCESS

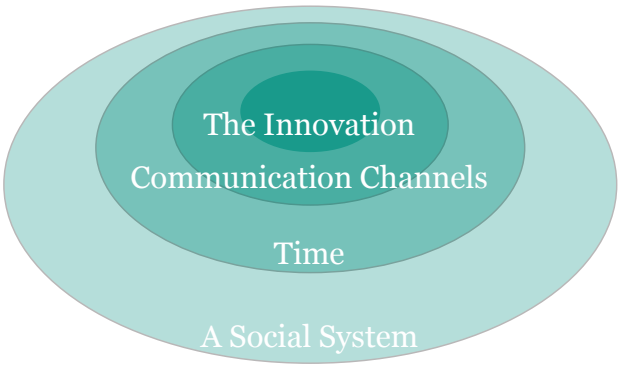
Consequences of innovations have received inadequate attention by change agents[4] and by diffusion researchers[5] which causes them to be desirable, undesirable, direct, indirect, intended, unintended, and anticipated or unanticipated[6]. A social system is involved in innovations consequences because certain of these changes occur at the system level, in addition to those that affect the individual.[7]

Extant literature suggests that innovation literature is colored by "pro-innovation bias" (Rogers 1983, Abrahamson 1991), that is, researchers and change agents, who are often also the financial sponsors of research, tacitly (unconsciously) assume that the consequences of innovation decisions will be positive and as desired by the change agents. The concept of pro-innovation bias has even become a theme in innovation literature yet paradoxically applied with a pro-innovation bias. Examples are studies exploring how change agents can ensure a higher success rate of new IT applications (Fichman 2004), or agriculture interventions (German, Mowo & Kingamkono 2006) by addressing their own pro-innovation bias (see also Gopalakrishnan 2000). A social system is defined as a set of interrelated units that are engaged in joint problem solving to accomplish a common goal. The members or units of a social system may be individuals, informal groups, organizations and/or subsystems. The system has

In diffusion of innovation theory, a pro-innovation bias reflects a personal bias toward a new innovation that someone is trying to implement or diffuse among a population. The bias refers to the fact that the innovation's "champion" has such strong bias in favor of the innovation, that he/she may not see its limitations or weaknesses and continues to promote it nonetheless. Rogers, Everett (Original edition (August 16, 2003)). Diffusion of Innovations.

a direct effect on diffusion through its norms and other system-level qualities, and also has an indirect influence through its individual members. Diffusion occurs within a social system. The social structure of the system affects the innovation's diffusion in several ways. The social system constitutes a boundary within which an innovation diffuses.8 Katz remarked, "It is unthinkable to study diffusion without some knowledge of the social structures in which potential adopters are located as it is to study blood circulation without adequate knowledge of the veins and arteries."

"Diffusion research is thus emerging as a single, integrated body of concepts and generalizations, even though the investigations are conducted by researchers in several scientific disciplines." – Everett M. Rogers with F. Floyd Shoemaker, Communication of Innovations: A cross-cultural approach.



Main Elements in the Diffusion of Innovations

Past diffusion investigations overlooked the fact that relevant activities and decisions usually occurred long before the diffusion process began: A perceived problem, funding decisions about R & D activities that led to research work, invention of the innovation and then its development and commercialization, a decision that it should be diffused, transfer of the innovation to a diffusion agency, and its communication to an audience of potential adopters. Then the first adoption occurs, and the diffusion process begins.[9] These unintended consequences, good or bad are usually a result of surprising interactions that take place due to the complexity that is added to an already existing social system when an innovation is diffused. This complexity can be better understood if we look for patterns and/or cause and effect relationships in order to plan for a knowable future. This can be achieved by using a visual tool for identifying patterns since there is a need for an external representation if the decisions to be made are for future than just for the present. Our minds are equipped enough to make decisions for the present but there needs to be an amplified device to make better informed decisions during the early phase of an innovation process. Jonathan Fish proposes that we are in need of an amplifying device because our mental resources for visual invention, as embodied in visual mental imagery, were originally better adapted

for perceiving and acting on the immediate present, than for imagining the future. This calls for the amplifying device to be an external representation which can help in pattern identification for a knowable future. Humans have the unique capacity to see the parts in relation to the whole, and therefore to see patterns and inconsistencies. “Of all our senses, vision is the most powerful and efficient channel for receiving information from the physical world. Approximately 70% of the sensory receptors in humans are dedicated to vision”, as Stephen Few suggests. Since visual tools form a natural bridge between the brain and the mind, and high intellectual performance on tasks requires more than linear processing, they can help the working teams to identify certain patterns in a complex social system. Visual tools are not only a means of external representation but also aid in forming the patterns that our brain makes when we look at a lot of information. The visual tools help in visualizing a mirror image of the patterns that our brain makes and the mind experiences. This would help in collaboration with people since the team members in a working team within an organization will be able to see the patterns and be on the same page. This thesis research claims that a visual tool can enable collaborative working teams within an organization to identify patterns in

a complex social system. This identification of patterns will help them make informed decisions much earlier in the process which will confirm better outcomes of their innovations and their consequences, good or bad. In order to find out how and what kind of a visual tool might enable them, I conducted a collaborative action research within a context making sure they meet the requirements of being an organization that does innovation and does it by following some kind of a process. During this research, I conducted ethnographic observations and generative tools that gave me a sense of their working styles and collaboration. Also, It enabled me to understand their process and how they follow it. I also conducted a generative tool activity based on what emerged from the analysis of observations and interviews. Following this, I was able to identify an appropriate opportunity and a framework for the visual tool in order to test it with a working team.

justification

The disparity that exists today between being highly innovative and simultaneously being unable to control or even sustain the environment in which we live is difficult to understand. On one hand, developing highly influential and top of the line products are really nothing new for Apple. The mega-company may have reached a new high with the launch of the hugely successful iPhone and iPad, which quite literally put the world at your fingertips."[10] At the same time, our ecosystems are declining; the economy is in a bad state, icebergs are melting at an alarming rate[11], there are conversations, documentaries and movies that depict how our future is in danger. There is a short sightedness in continuing to innovate at this level, without addressing some of the critical issues in today's rapidly changing world-- one in which there are more hurricanes, fewer wetlands, more limits on resources and less credit to go around-- and in which there will be more change tomorrow. There is a choice. Innovate responsibly and take into account every dimension of our environment – not just our natural environment, but also the social, economic and cultural elements[12]. There are consequences, both intended and unintended, which need to be identified before an innovation is diffused into

any of these eco-systems, and before any of these consequences become uncontrollable. Since human beings will always innovate, and the number of innovations will continue to grow, they are being added to already existing natural and social systems, thereby adding to their complexity[13]. The nature of such complex problems is ill structured; there is no problem-solving algorithm as in the case of well-structured problems[14]. This complexity can be better understood to plan for a more knowable future if we look for patterns, connections and causal relationships[15], which otherwise leads to surprising interactions and unintended consequences. In addition, the corporate sector is accountable for two-thirds global trade; they play a critical role in solving these challenges while building their businesses[16]. These organizations consist of working teams as their fundamental learning units[17], offering their support in understanding the complexity that integrative thinking thrives upon. A collaborative working approach could help us break free from conventional notions, by using each other's expertise, which would enable us to reach creative resolutions.[18]

Jonathan Fish proposes that we are in need of an amplifying device because our mental resources for visual invention, as embodied in visual mental imagery, were originally better adapted

for perceiving and acting on the immediate present[19], than for imagining the future. This calls for the amplifying device to be an external representation which can help in pattern identification for a knowable future. Humans have the unique capacity to see the parts in relation to the whole, and therefore to see patterns and inconsistencies[20]. “Of all our senses, vision is the most powerful and efficient channel for receiving information from the physical world. Approximately 70% of the sensory receptors in humans are dedicated to vision”, as Stephen Few suggests. Since visual tools form a natural bridge between the brain and the mind, and high intellectual performance on tasks requires more than linear processing, they can help the working teams to identify certain patterns in a complex social system.

“Past diffusion investigations overlooked the fact that relevant decisions usually occurred long before the diffusion of an innovation took place. Unfortunately, there are only a few investigations of the early phases in the innovation development process.”[21], Everett M. Rogers in Diffusion of Innovations. Therefore, my research is based on the proposition of a visual tool in the problem framing phase of an innovation development process that helps a working team within an organization to identify patterns in or-

der to understand complexity in a social system. This will assist the organization in making relevant decisions towards a knowable future before the diffusion of an innovation takes place. A research methodology is farmed in order to conduct this research within a context to test the results of such a visual tool. Before testing the results,, research methodologies like ethnographic observations, contextual interviews and generative tools were adopted in order to understand the current situation of the context. While understanding this situation, a broader claim emerged-that how important it is for an organization to adhere to its process deliberately and in understanding how a visual tool might help in such a situation. Concentrating on enabling the team identifying patterns in a complex social system seemed to be the perfect path of this thesis research. However, it was soon realized that following the process was a pre requisite that was needed in order to use the visual tool to identify patterns. There was a clear line differentiating what people said they did and what they did which led to a change in my focus from identifying patterns in a complex social system to identifying patterns in order to clearly define a problem. This happened because of being able to identify their not defining of a problem clearly which led them to keep coming back and trying to be on the same page during the entire process rather

than fluidly moving forward in their process, as an opportunity. The new problem statement was changed to : How might a visual tool enable collaborative working teams within an organization to identify patterns in order to clearly define a problem?

notes

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(Rogers 1995, 132)

limitations

The primary objective of my research is to design a visual tool and find out ways in which it might enable a working team within an organization to identify patterns in a complex social system. The action research will need to be conducted within a three month period, and hence I have made some choices that will help me to remain focused and expedite my process. First, my research will be conducted within a context of a working team in an organization. It will help the team to identify patterns in a social system by using a visual tool. The organization should innovation driven that follows a process and consists of collaborative working teams. I have identified PRIIO, Developers of Intelligent, Interactive Products as my context where the action research will take place. At PRIIO they help clients realize their vision by applying a proven process to design and develop intelligent, interactive products.

The investigation will take place in the early phases of the innovation development process that is the problem framing phase. The visual tool designed will be applied within the working team context at PRIIO that will lead them to identify patterns in a social system. The visual tool will be designed and

developed based on the analysis of the context. Also, the visual tool's primary purpose will be to identify patterns, it will not matter if it does/does not serve any other purpose. The action research will stay limited to pattern identification in a social system that starts to hint towards informed decisions or appropriate outcomes. It might or might not directly point towards unintended consequences, which could be negative or positive. Also, the results of the prototype testing will only need to perform the functions as specified in the process of the tool. It is not the intention of the thesis to make sure that the working team uses the tool for their use or benefit. The scope of the thesis is limited to the successful user testing of the visual tool defined. It is not the purpose of this thesis research to validate the need for identifying patterns or to clearly define a problem in organizations. Rather, the intention is to research how a visual tool can enable working teams to clearly define a problem. Also, it is not within the scope of this research to make sure that the context sees value in this tool and eventually uses the tool to their benefit. The context is placed in order to analyze the findings and observations and to make meaning at an abstract level. Again, the scope of this research is only limited to answering the research question and the sub questions attached to it.

project description

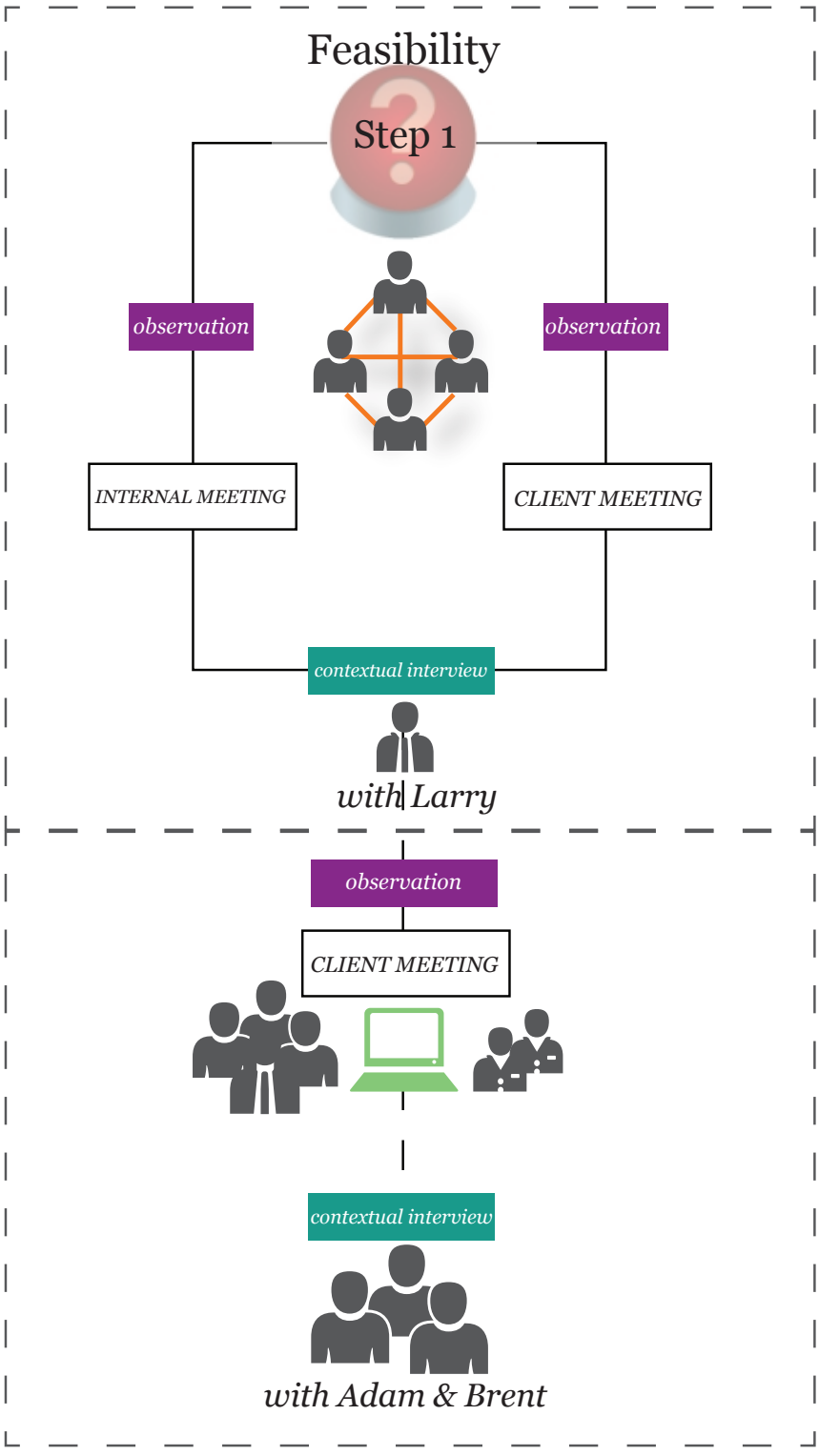
The initial path of this thesis was to formulate a research problem which was done mainly by secondary research. The research problem involved a proven theory by looking for patterns and connections among different theories. A detailed research plan was also developed as to how and when the collaborative research will be conducted within an identified context. For this purpose, I identified PRIIO, a product innovation firm based in Indianapolis since it is an innovation firm in which they work as a collaborative team. Also, they have their own innovation process that they follow in order to execute their projects.

WORKSHOP AT PRIIO

They are a multi-disciplinary team and they call themselves architects of a solution. This means that they not only provide an answer for the short term, but can also envision solutions which address the long term. Hence, they appeared to fit my context requirements. I divided my research in a basic timeline dividing them by i. observation and analysis, ii. Link insights into a framework and identify opportunity space, iii. Ideation, prototyping and feedback. First, a research methodology was developed to understand the collaboration styles of a working team within PRIIO, their ways of interaction, their ways of following their process during the initial stages, their usage of tools and/or visual tools and if at all they identify patterns during any stage of their process. I conducted ethnographic observation and thereafter contextual interviews based on those. Ethnography is one of the most common methods for collecting data which is direct, first-hand observation of daily participation. This can include participant observation. Another common method is interviewing, which may include conversation with different levels of form and can involve small talk to long interviews. The initial observations were based on 2 parts, one of them was an internal meeting or rather a pre-meeting for an upcoming client meeting, and the second one was the client meeting itself. The interviews were based on these observations. They were con-

ducted with the President of the organization individually and another one was conducted with the team members collectively. Second, the data collected was analyzed through visuals and abstracted diagrams in order to make sense out of it and understand their current working styles and ways of working in collaboration. These visuals were analyzed based on the Liz Sanders framework of learning from what people say, think, do, use, know, feel and dream. There was a clear distinction of what people say they do and what they do in my analysis in terms of their working styles and also in their way of following their process. This resulted in tweaking the focus of my research. Also, the synthesis informed my research methodology from here on. Based on this understanding I shifted the focus from 'identifying patterns in a complex social system of the end users of their products' to identifying patterns within their own complex social system, that is working team within PRIIO itself'. Third, based on this synthesis I developed my generative tool to understand their experience during an internal meeting. The focus was to understand their flow of interaction during an internal meeting during the initial stages of their process. They were asked to draw/write/make the flow of their interaction between their team members at a meeting during the initial phase

of a design project. This making gave my research another perspective of understanding their experience during their interaction. The location of these was their office location and it was conducted with 2 of the team members, an industrial designer and an engineer. Fourth, the data collected was analyzed and synthesized through visualizations in order to look for patterns and relationships. The analysis of observations and interviews were compared In order to look for patterns that showed the way for an opportunity. This newly framed opportunity shifted my focus again in order to help the working team within PRIIO clearly define a problem by looking for patterns in their fuzzy situations much earlier in the process. Based on this opportunity, a framework was defined in order to make a visual tool that would enable the working teams to identify patterns in order to clearly define a problem. The prototype was further tested and results analyzed in order to reach a conclusion.


Feasibility
Step 1
observation
observation
INTERNAL MEETING
CLIENT MEETING
contextual interview
with Larry
observation
CLIENT MEETING
contextual interview
with Adam & Brent

(i.) Observation and analysis

Ethnography is a scientific research strategy often used in the field of social sciences, particularly in anthropology and in some branches of sociology, also known as part of historical science that studies people, ethnic groups and other ethnic formations, their ethno genesis, composition, resettlement, social welfare characteristics, as well as their material and spiritual culture. It is often employed for gathering empirical data on human societies and cultures. Data collection is often done through participant observation, interviews, questionnaires, etc. Ethnography aims to describe the nature of those who are studied (i.e. to describe a people, an ethnos) through writing. In the biological sciences, this type of study might be called a "field study" or a "case report," both of which are used as common synonyms for "ethnography". One of the most common methods for collecting data in an ethnographic study is direct, first-hand observation of daily participation. This can include participant observation. Another common method is interviewing, which may include conversation with different levels of form and can involve small talk to long interviews. A particular approach to transcribing interview data might be genealogical method. This is a set of procedures by which ethnographers discover and record connections of kinship, descent

and marriage using diagrams and symbols. Questionnaires can be used to aid the discovery of local beliefs and perceptions and in the case of longitudinal research, where there is continuous long-term study of an area or site, they can act as valid instrument for measuring changes in the individuals or groups studied. Traditionally, the ethnographer focuses attention on a community, selecting knowledgeable informants who know well the activities of the community. These informants are typically asked to identify other informants who represent the community, often using chain sampling. This process is often effective in revealing common cultural common denominators connected to the topic being studied. Ethnography relies greatly on up-close, personal experience. Participation, rather than just observation, is one of the keys to this process. The ethnographic method is used across a range of different disciplines, primarily by anthropologists but also frequently by sociologists. Cultural studies, economics, social work, education, ethnomusicology, folklore, geography, history, linguistics, communication studies, performance studies, psychology, usability and criminology are other fields which have made use of ethnography. Observational research is not a single thing. The decision to employ field methods in gathering informational data is only the first step in a decision process that involves a large num-

ber of options and possibilities. Making the choice to employ field methods involves a commitment to get close to the subject being observed in its natural setting, to be factual and descriptive in reporting what is observed, and to find out the points of view of participants in the domain observed. Once these fundamental commitments have been made, it is necessary to make additional decisions about which particular observational approaches are appropriate for the research situation at hand. The first and most fundamental distinction among observational strategies concerns the extent to which the observer is also a participant in the program activities being studied. This is not really a simple choice between participation and nonparticipation. The extent of participation is a continuum which varies from complete immersion in the program as full participant to complete separation from the activities observed, taking on a role as spectator; there is a great deal of variation along the continuum between these two extremes. Participant observation is an omnibus field strategy in that it "simultaneously combines document analysis, interviewing of respondents and informants, direct participation and observation, and introspection. In participant observation the researcher shares as intimately as possible in the life and activities of the people in the observed setting. The purpose of such

participation is to develop an insider's view of what is happening. This means that the researcher not only sees what is happening but "feels" what it is like to be part of the group. Experiencing an environment as an insider is what necessitates the participant part of participant observation. At the same time, however, there is clearly an observer side to this process. The challenge is to combine participation and observation so as to become capable of understanding the experience as an insider while describing the experience for outsiders. The extent to which it is possible for a researcher to become a full participant in an experience will depend partly on the nature of the setting being observed. It is sometimes emphasized that, besides seeking to "understand", the ethnographer must also try to see familiar settings as "anthropologically strange", as they would be seen by someone from another society, adopting what we might call the Martian perspective.

The observation was conducted in the natural environment of PRIIO at their office location in Indianapolis. The first observation session was a pre client meeting over their lunch time. Almost the entire working team was present, there were 6 participants in this observation and their agenda was to make everyone familiar with

the new client and to answer any questions that the team members might have. This team included the CEO of the organization, the industrial designer, engineers and project manager. The president and the project manager introduced the client to the rest of the team and answered most questions; they had a discussion about the agenda and the location within their office for the client meeting. This meeting was an informal one and a few of them had a few sheets of paper to take notes on. They asked questions and/or informed each other about the client in a random fashion. While it is not possible to draw conclusions after one ethnographic observation, some key points can be identified for further investigation. It is interesting to note that meeting was more of a free flowing conversation. It was more random than an ordered one. They did not essentially have a well described agenda for their meeting though they all verbally knew the purpose of the meeting. The team did not use any tool either to write or scribble out any important points during the meeting. The second observation was conducted during the client meeting in a similar natural environment. This was the meeting for which the team at PRIIO had a pre client meeting. Similar to the earlier meeting, there were 6 team members from PRIIO and 2 from the client team. The client had brought along with them a few products

to share with the working team which were the present product styles that were being used for their purpose. These were circulated around the table for all the participants and any of them asked questions to be answered by the client. The clients discussed a little about the consumer environment in which they would use the product. Most of the discussion was around the technical aspect of the new product to be developed. This meeting ended with a discussion about the cost and the quantity of the product and deadlines. After this meeting, it was interesting to notice that they had been using a few terms like 'what', 'how', 'prototyping', 'human factors', 'form follows function'. The entire team at PRIIO was a part of the entire discussion, including their financial negotiations. They did not necessarily have a described agenda. The president and the project manager led the discussion during the meeting along with the client and everyone else was free to ask questions and bring up any concerns and/or comments. Based on these 2 ethnographic observations, contextual interviews were conducted. One of them was conducted individually with the president of PRIIO and the other one was conducted with 2 of the team members who are an engineer and a designer. During the first interview with the president, it was a general recall of what the purpose was for both the meetings to be held in such

a short time span. Also, he mentioned that in order for the team members to gain a sense of ownership towards the projects they are made a part of the entire client meeting including their financials. They believed in having transparency so that it is easier for his team members to own the process and the projects. Also they are free to ask any questions or display any concerns towards technical matters, design matters or time deadline matters. Another interesting point was that they wanted the organization to be remembered as a 'design thinking' organization rather than a product organization and because of this reason they tried to incorporate the terms that they used so that the team members start owning them. Based on the research so far, the data collected was visualized as it is and then in an abstract manner in order to get to deeper insights. The role that the team members played during their meetings was a participant. During all the meetings that were observed, a particular team member would either ask a question or respond about his field of expertise. There was no explicit process discussion or a differentiation in their process or content, neither did they explicitly diverge or converge. Another notable point about their process was that the client was the face of the users for them. The team tried to understand the users or the consumers through the client. And the clients acted as informants of their

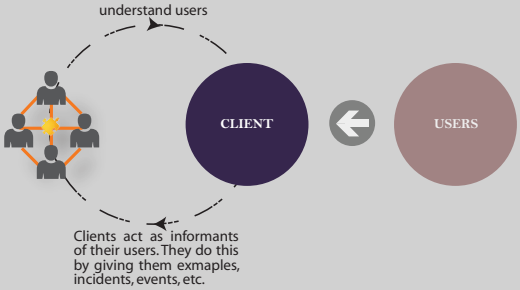
users. They often did this by giving them examples, incidents or events that occurred with regard to the consumers. Also, the working teams at PRIIO did not pull together the working of the group as a product. The rich patterns were being lost in their experience. The nature of their meetings was haphazard which made it difficult for them to build on each other's ideas or use each other's experience and expertise to come up with innovative ideas.

Analysis based on their nature of meetings, process and their productivity

Nature of meetings

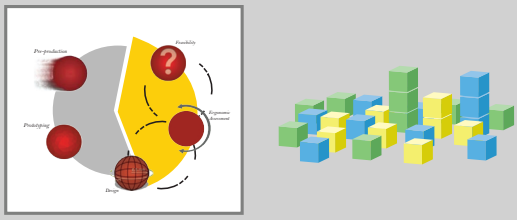
Free flowing, open ended conversations, similar to an external meeting with a client. the entire team is present at all times. Subject experts are responsible for their own field of expertise in order to ask or answer questions

Process



Users usually are not a part of the process at PRIIO. Their role is either performed by the client or PRIIO does the user testing either among themselves or with the help of the client.

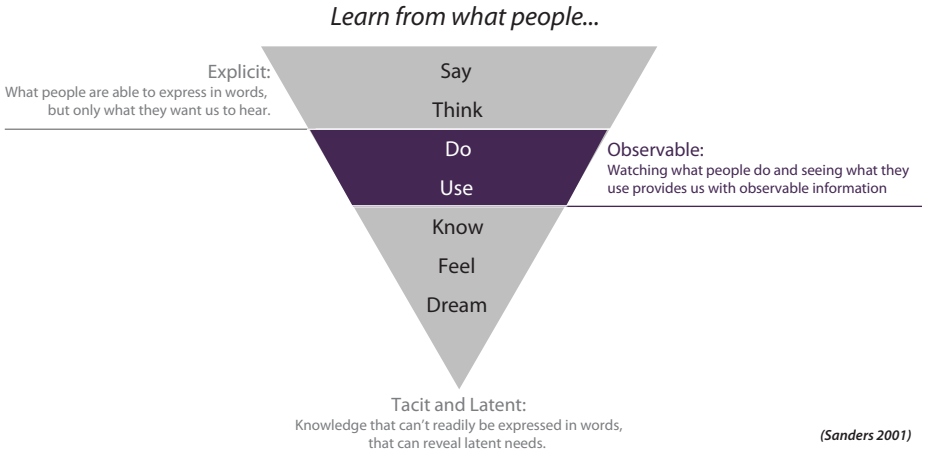
Productivity (meetings and collaboration)



The working teams at PRIIO do not pull together the learning of the group as a product. The rich patterns are lost ion their experience. The nature of their meetings is haphazard which makes it difficult to build on each others ideas or use each others experience and expertise to come up with innovatice ideas.

(ii.) Link insights into a framework

Once these insights were developed and I had covered the aspects of what they said they did and what they did, it was interesting to find a thin line running between those two aspects. According to Liz Sanders, each route to experience reveals a different story or picture. Listening to what people say tells us what they are able to express in words (i.e., explicit knowledge). But it only gives us what they want us to hear. Watching what people do and seeing what they use provides us with observable information (or observed experience).



LIZ SANDERS DESIGN RESEARCH MODEL

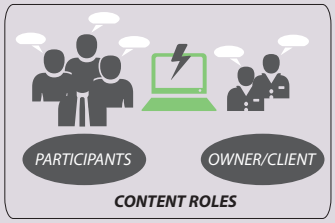
But knowing what people say/think, do and use (Cain, 1998) is not enough (Sanders, 1992). Discovering what people think and know provides us with their perceptions of experience. Understanding how people feel gives us the ability to empathize with them. This way of knowing provides tacit knowledge, i.e., knowledge that can't readily be expressed in words (Polanyi, 1983). Seeing and appreciating what people dream shows us how their future could change for the better. It is another form of tacit knowledge that can reveal latent needs, i.e., needs not recognizable until the future. For example, the Internet has been revealing many previously latent communication needs. The different ways of accessing experience have evolved over time. Traditional design research methods were focused primarily on observational research (i.e., looking at what people do and use). Traditional market research methods, on the other hand, have been focused more on what people say and think (through focus groups, interviews, and questionnaires). The new tools are focused on what people make, i.e., what they create from the toolkits we provide for them to use in expressing their thoughts, feelings and dreams. Every artifact tells a story and so we typically ask the creator of the artifact to tell us that story. The stories associated with the artifacts from the emotional toolkits tell

of feelings, dreams, fears, and aspirations. The stories associated with the artifacts from the cognitive toolkits tell us how people understand and misunderstand things, events and places. The cognitive toolkits can also reveal the intuitive relationships between system components By knowing how to access people's feelings and ideas, we are able to establish resonance between a company and its customers. Resonating, or being in synch with one's customers, means being able to quickly respond to their changing needs and aspirations. Resonance can be achieved by inviting users to play a role in the design development process.

Since the data collected in observations and interviews was abstracted into visualizations to provide a visual perspective and that allowed for the emergence of deeper insights. These insights were linked into the above mentioned framework and another analysis was completed in order to define further steps. Based on the framework it was further synthesized that the nature of meetings at PRIIO was more content based where each participant had a content role. Each participant was selected for 'what' they contributed in knowledge and solved the problem which fell under their expertise. Both the team and the client played a content role and focused majorly on the content.

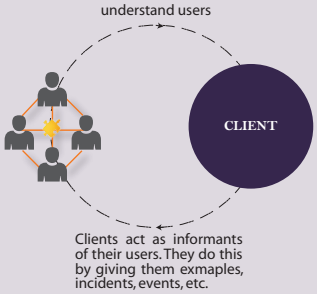
Analysis based on Liz Sanders framework

Nature of meetings



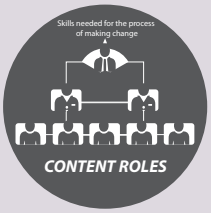
"The participant is a content role. The participants are selected for 'what' they can contribute in knowledge, etc. they are there to help the owner find a solution to his/her problem"
- Following the process with Others, The Power of Innovation

An effective, not adaptive organization



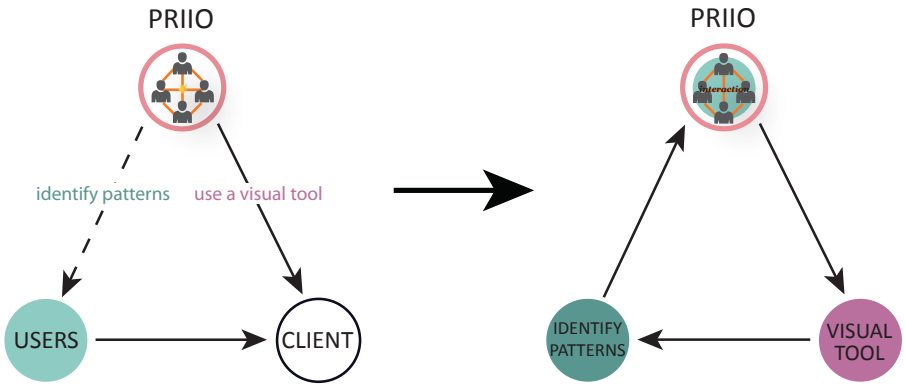
"An effective organization follows a well-structured, stable routine for delivering its 'poduct' in high quantities and high quality and at low cost.
Adaptable people and organizations anticipate problems and opportunities, and develop timely solutions and new routines, which requires looking outside the organization for new technologies, ideas and methods that may improve or completely change its routine."
- The Power of Innovation

Productivity: heirarchy in their structure



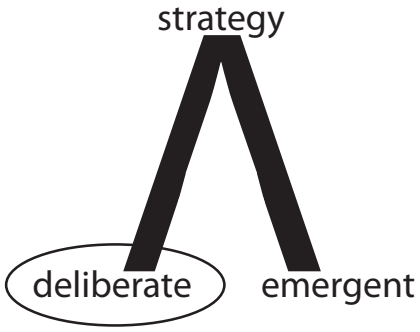
Larry tries to be the facilitator or the coach of his working team, but does not play this role during meetings. The working team focuses only on the content and not on the process.

There was no mention of their process even during their internal meetings. It was also noticed that PRIIO acts as an effective organization that followed a well-structured, stable routine for delivering its product in high quantities and high quality and tried to keep the cost low. They are not similar to adaptive organizations that anticipate problems and opportunities and develop timely solutions and new routines, which require looking outside the organization for new technologies, ideas and methods that may improve or completely change its routine. Also, it became very clear by now that they have a hierarchy in their structure, they do not seem to be a flat hierarchy. Based on this analysis, the focus of my research took a twist. Before, the goal was to identify patterns in a complex social system of the consumers but now the same complex social system was replaced by PRIIO's team.



SHIFT IN FOCUS OF RESEARCH FROM COMPLEX SOCIAL SYSTEM OF USERS TO COMPLEX SOCIAL SYSTEM OF WORKING TEAM WITHIN PRIIO

Also, since strategy making has two feet, one deliberate and one emergent, I will use the deliberate approach to help PRIIO identify patterns within their own social system which will help them make informed decisions and come up with appropriate outcomes by looking at their own organization as a system because systems theory has brought a new perspective for managers to interpret patterns and events in their organizations.



"In practice, all strategy making walks on two feet, one deliberate, the other emergent. For just as purely deliberate strategy making precludes learning, so purely emergent strategy making precludes control. Pushed to the limit, neither approach makes much sense. Learning must be coupled with control. "

Mintzberg, Henry. "Crafting Strategy." Pp. 161 in J. S. Ott (Ed.),

Very basically, systems' thinking is a way of helping a person to view the world, including its organizations, from a broad perspective that includes structures, patterns and events, rather than just the events themselves. This broad view helps one to identify the real causes of issues and know where to work to address them. The ideas for innovation are often developed in a

certain pattern within the interaction system. These ideas maybe the result of the employee's daily interaction, for example with colleagues and customers. Managers now diagnose problems, not by examining what appear to be separate pieces of the organization, but by recognizing larger patterns of interactions. Based on these conscious decisions, further steps were defined. A few members of the team, the engineer and the industrial designer participated in filling out a questionnaire and in making and artifact that will help the researcher to understand their experience during the initial stages of their design process. It was important to take note of their interactions during their initial phases of the process that would help to define the possible opportunities.

PARTICIPANTS FILLING OUT THE QUESTIONNAIRE

The questionnaire given to both the participants consisted of brief questions concerning their disciplines, their area of specialization, and with open ended questions, such as reflections on working together in a team and how they learnt about a problem. Initially they were asked to explain their flow of interaction in the initial phases of the design process until the time when they were ready with the perceived solutions or recommendations. Also, they were given the choice to visually map out the flow of their interaction within the team through participatory research methods; a generative tool was used in this case in order to elicit visual responses. Using such stimulants, participants were asked to visually make a map of their experiences; they were given materials like post-its, white paper sheets, pens, markers, stickers. They could also simply write and not draw or make if they felt like. They were given the freedom to add their own drawing or sketches or anything else that they felt relevant. The visual responses of the participants were aimed to reflect their engagement and inspiration for their experience. This informed the memories of the process that they claimed to follow. These visual responses also reflected the participants own use of visual communication methods. Working on the white board, each participant was provided with a large white sheet stuck on to the board, markers and post-its.

The post-its labels included the names of the team members to depict their roles wherever applicable. These were color coded beforehand. At the beginning of the activity, each participant was asked to think about a project that wanted to reflect on. These visuals that they made were different in the way they expressed their experience. The engineer took more time to think and kept looking at what the designer was making to generate ideas on how to get started. The designer didn't take time to get started.

PARTICIPANTS MAKING THEIR EXPERIENCE OF FLOW OF INTERACTION BETWEEN TEAM MEMBERS DURING THE INITIAL PHASE OF A PROJECT

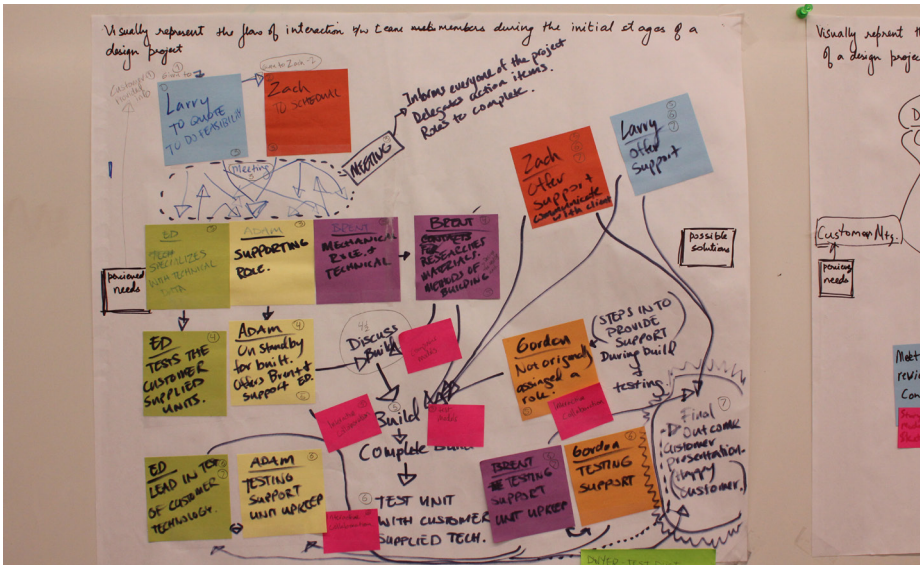
At the end of their making these artifacts, they were given smaller and a different colored post-it and a list of the possible visual means that they might have used during their flow of interaction. The participants were asked to write down each of their methods

and paste it next to the step at which they thought they used it. At the completion of this activity, there was a discussion on what they just did and what they thought about it. The data collected included 2 filled up questionnaires and the two artifacts that the participants had created on their own.

DATA COLLECTED: THEIR EXPERIENCES OF FLOW OF INTERACTION BETWEEN TEAM MEMBERS DURING THE INITIAL PHASE OF A PROJECT

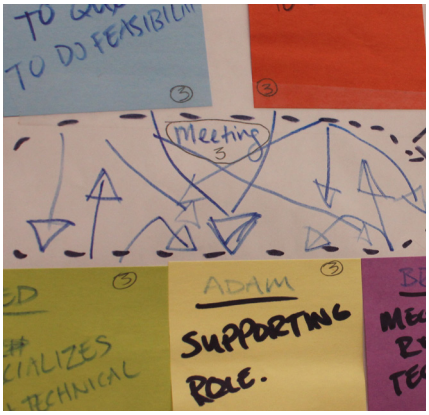
To start analyzing the results, I read through their questionnaires and sorted out similarities and dissimilarities. Afterwards, the flow of interaction of the two experiences was abstracted using their information that they shared. Again, the data collected was abstracted into diagrams to provide a visual perspective that allowed for the emergence of an opportunity. The flow of interaction between the team members was highly interactive and that gave way to re-

lationships and interactions across all the team members and the process. The participants only offered the individual perspective of each of them but their description of the interactions through visuals included the interactions between all the team members as well as the corresponding process that they all went through.



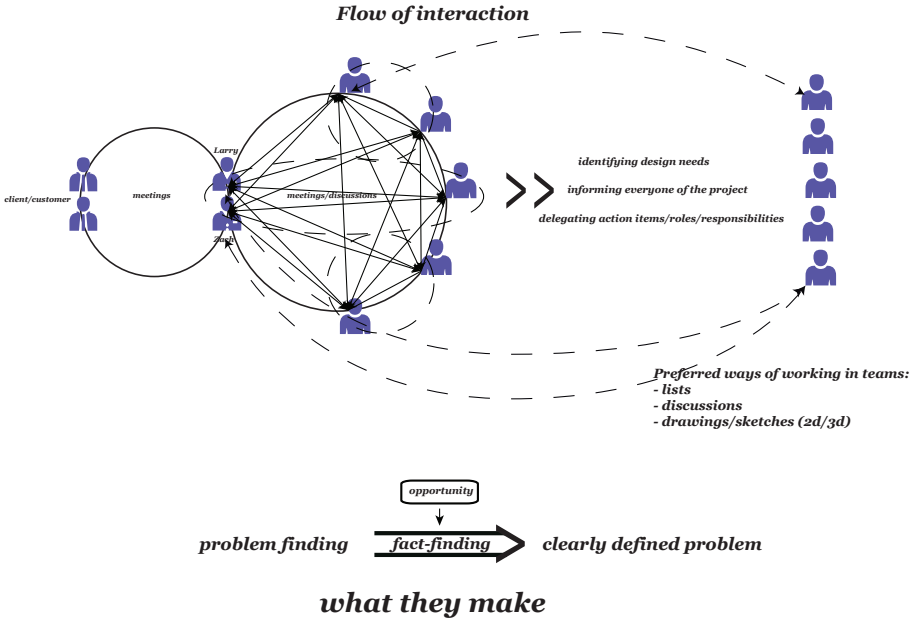
ARTIFACTS MADE BY THE PARTICIPANTS

A general way of communication emerged after analyzing the artifacts that the participants had made. In both the case studies, their interaction started with the customer needs and the president of PRIIO. The client was not a part of their company and would approach them for projects. The initial flow of information occurred between the president and the project manager. The they had preliminary interactions for a project to define the scope of the project and this took place through meetings and email exchanges in a random fashion which was depicted through arrows all across. In general, their flow of interaction was a random process and they exchanges a numerous amount of emails which was a dominant way of interaction and a tool sued amongst them.



IDENTIFIED OPPORTUNITY WITHIN THE PARTICIPANTS DATA THAT WAS COLLECTED

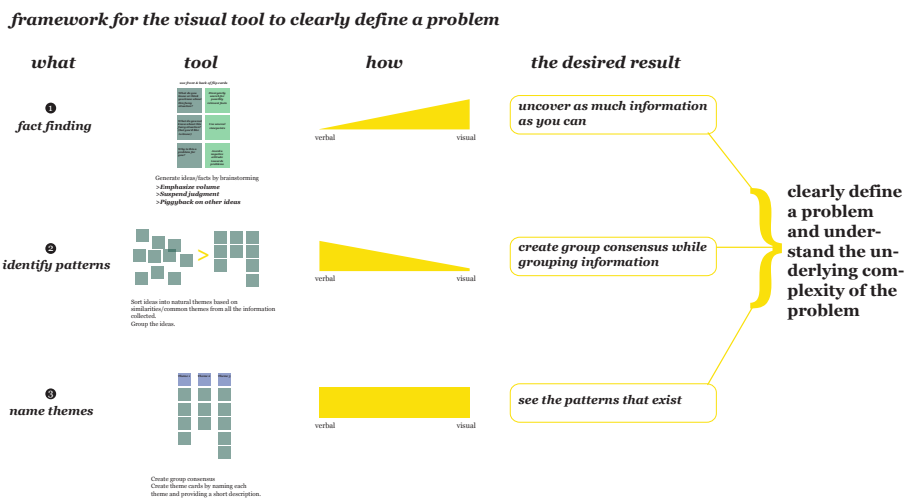
It was seen as an opportunity that they needed to define their problem clearly before they went on to the next steps because it had come up during discussions that often they had to go back to their process because of either of them, the client or the team being misinformed of a fact/s. this was also clearly depicted by the way they used arrows in their visual to depict interaction in a very random manner.



ANALYSIS BASED ON THE ARTIFACTS CREATED BY THE PARTICIPANTS

It was found out that they needed a way to define their problem clearly by using fact finding as a methodology. A framework was developed in order to help the team clearly define a problem. Also, since the products they deal with are usually complex technical products the challenges that they face are

usually complex. And in order to understand the underlying complexity of a problem, they need to identify patterns by using an appropriate method. Hence, a process was developed which could take them through the problem defining process The process was divided into 3 parts, which let them uncover as many facts as much possible, creating group consensus while grouping information and seeing the patterns that exist. This would help them in understanding the complexity of their problem and be able to clearly define it with the help of those patterns.



FRAMEWORK FOR THE VISUAL TOOL

A tool was designed and developed and tested with the team at PRIIO using the process. The first step of uncovering as many facts was accompanied by a set of flip cards that contained stimulants to their thinking by asking questions, example, why is this a problem for you,

or what would you have if this problem were solved, and also, who, what, when , where and why. These helped in getting them started.

WORKING TEAM AT PRIIO
USING AND TESTING THE VISUAL TOOL TO IDNETIFY PATTERNS

The participants were able to uncover the facts and identify patterns out of them. Another point to be noted was that the group consensus brought about fruitful discussions which helped the team in understanding their problem and hence defining it clearly.

conclusion

This thesis research brings to light how complexity can be easily understood if one tries to identify patterns, cause and effect relationships and connections. It also suggests the need to frame and reframe the project or the problem at hand based on the context and the findings that one comes across. An important learning comes about by understanding the clarity and the difference in what people say they do, what they do and what they make. These help in understanding what people want others to hear and using other observable information against it in order to get a holistic view of peoples' experiences. This research also emphasized the team's collaboration and their interaction ways and methods. It also suggests the importance of separating process and content in an explicit way.

It also suggests the need for better use of visual means by all disciplines. Some professionals can benefit from learning how to use visual means to ensure collaboration. Visualizations can be a powerful tool when a working team wants to generate numerous ideas. Another benefit is these tools acting as a communication means that generate fruitful and important discussions.

After the prototype testing, during discussions about its reflection the president of PRIIO mentioned that they already follow this process of defining a problem. Hence there are opportunities to expand the context beyond the existing scope and take it further to explain the value of defining a problem to the context. Also, it will be invaluable to be able to be able show them the entire picture of how pattern uncovering all the facts can be an important factor in understanding the breadth and depth of a problem. Currently, there also exist a few visual tools that are being used in the industry In order to identify patterns but here the tool is specifically designed in order to be able to clearly define a problem

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appendix

1. *Diffusion of Innovations [fourth edition]- Everett M. Rogers*

During the past thirty years or so, diffusion research has grown to be widely recognized, applied and admired, but it has also been subjected to both constructive and destructive criticism. This criticism is due in large part to the stereotyped and limited ways in which many diffusion scholars have defined the scope and method of their field of study. Rogers analyzes the limitations of previous diffusion studies, showing, for example, that the convergence model, by which participants create and share information to reach a mutual understanding, more accurately describes diffusion in most cases than the linear model. Rogers provides an entirely new set of case examples, from the Balinese Water Temple to Nintendo videogames, that beautifully illustrate his expansive research, as well as a completely revised bibliography covering all relevant diffusion scholarship in the past decade. Most important, he discusses recent research and current topics, including social marketing, forecasting the rate of adoption, technology transfer, and more. This all-inclusive work will be essential reading for scholars and students in the fields of communications, marketing, geography, economic development, political

science, sociology, and other related fields for generations to come.

2. *Design is the Problem: The Future of Design must be Sustainable - Nathan Shedroff [foreword by Hunter Lovins]*

Design makes a tremendous impact on the produced world in terms of usability, resources, understanding, and priorities. What we produce, how we serve customers and other stakeholders, and even how we understand how the world works is all affected by the design of models and solutions. Designers have an unprecedented opportunity to use their skills to make meaningful, sustainable change in the world—if they know how to focus their skills, time, and agendas. In Design is the Problem: The Future of Design Must be Sustainable, Nathan Shedroff examines how the endemic culture of design often creates unsustainable solutions, and shows how designers can bake sustainability into their design processes in order to produce more sustainable solutions. Design is the Problem explains:

a.How sustainability isn't as difficult to understand and address as many would have you think

b.Several of the leading frameworks and perspectives on sustainability

c.How to insert sustainability into the development process that

you're already using

d. The many, practical strategies that make the products, services, and events you design and develop more sustainable—right now

3.*The Opposable Mind: How successful Leaders win though Integrative Thinking - Roger Martin*

Martin argues that to emulate the world's best leaders people need to study how leaders think. He argues integrative thinking, is a common feature found in successful leaders. The book gives a working definition of integrative thinking as: "The ability to face constructively the tension of opposing ideas and, instead of choosing one at the expense of the other, generate a creative resolution of the tension in the form of a new idea that contains elements of the opposing ideas but is superior to each". Martin notes some of the major differences between integrative thinkers and conventional thinkers. Integrative thinkers: take a broad view of what is salient despite the increase it causes in the complexity of problems, consider multi directional and non-linear causal relationships, keep the entire problem in mind while working on individual segments, and search for creative resolutions rather than accept trade offs. In the second half of the book Martin outlines how to develop in-

tegrative thinking capabilities. The three main components that make up the integrative thinkers personal knowledge system are stance, tools and experience; “the tripod supporting the system”. Martin devotes a chapter to each element of the tripod, explaining their significance in the integrative thinker’s development and how they combine to create an effective integrative thinker. Throughout the book, Martin studies the thought processes of prominent leaders and for each chapter uses several examples outlining how the leader used a particular aspect of integrative thinking to create successful strategy.

4.*The Fifth Discipline: The Art and Practice of the Learning organization*

-PeterM. Senge

This book focuses on group problem solving using the systems thinking method in order to convert companies into learning organizations. The five disciplines represent approaches (theories and methods) for developing three core learning capabilities: fostering aspiration, developing reflective conversation, and understanding complexity. The five disciplines of the learning organization discussed in the book are:

• “Personal mastery is a discipline of continually clarifying and

deepening our personal vision, of

focusing our energies, of developing patience, and of seeing reality objectively." (p. 7)

• "Mental models are deeply ingrained assumptions, generalizations, or even pictures of images

that influence how we understand the world and how we take action." (p. 8)

• "Building shared vision a practice of unearthing shared pictures of the future that foster genuine

commitment and enrollment rather than compliance." (p. 9)

• "Team learning starts with dialogue, the capacity of members of a team to suspend assumptions and enter into genuine thinking together." (p. 10)

• Systems thinking - The Fifth Discipline that integrates the other 4. "Systems thinking also needs the disciplines of building shared vision, mental models, team learning, and personal mastery to realize its potential. Building shared vision fosters a commitment to the long term. Mental models focus on the openness needed to unearth shortcomings in our present ways of seeing the world. Team learning develops the skills of groups of people to look for the larger picture beyond individual perspectives. And personal mastery fosters the personal motivation to continually

learn how our actions affect our world."

5. *The Truth about Green Business*

- Gil Friend

The Truth About Green Business, by Natural Logic CEO Gil Friend, brings together 52 crucial facts and insights leaders must know to successfully "go green." This book delivers quick, plain-English explanations that executives, decision-makers, and entrepreneurs can actually use, no matter what kind of businesses they're running, or what their environmental and profit goals are.

6. *GSD 08 Platform*

- Harvard University Graduate School of Design

GSD 08 Platform formulates prevalent tendencies and coherences among the many that operate within the Harvard Graduate School of Design. Its content groupings are the site of relations between a diverse range of projects and research, developing affinities between projects, events, and writings and revealing a cross-section of ideas and interests. More than a mere recording of lectures, publications, and exhibitions, this book unravels a new order of experiences and discoveries. Featuring texts by: Shigeru Ban, Teddy Cruz, Erwan Bouroullec, Rowan Bouroul-

lec, Jacques Herzog, Pierre de Meuron, Rem Koolhaas, Mohsen Mostafavi,Sanford Kwinter, Farshid Moussavi, Sarah Whiting, IÃ±aki Abalos, George Legendre, Hani Rashid, Peter Eisenman, Joan Busquets, Felipe Correa, Jorge Silvetti,Hashim Sarkis, Jeff Kipnis, and many others.

7. *The Ten faces of Innovation*

- Tom Kelley with Jonathan Littman

The role of the devil's advocate is nearly universal in business today. It allows individuals to step outside themselves and raise questions and concerns that effectively kill new projects and ideas, while claiming no personal responsibility. Nothing is more potent in stifling innovation as Tom Kelley points out in The Ten Faces of Innovation.

Over the years, Tom has observed a number of roles that people can play in an organization to foster innovation and new ideas while offering an effective counter to naysayers. Among these approaches are the Anthropologist, the person who goes into the field to see how customers use and respond to products, to come up with new innovations; the Cross-Pollinator, who mixes and matches ideas, widely disparate people, and technologies to create new ideas that can drive growth; and the Hurdler, who instantly looks for ways to

overcome the limits and challenges to any situation.

Filled with engaging stories of how companies such as Kraft, Samsung, and Procter & Gamble have incorporated IDEO's thinking to transform the customer experience, The Ten Faces of Innovation is an extraordinary guide to nurturing and sustaining a culture of continuous innovation and renewal.

8. *The Art of Innovation*

- Tom Kelley with Jonathan Littman

IDEO, the world's leading design firm, is the brain trust that's behind some of the more brilliant innovations of the past 20 years--from the Apple mouse, the Polaroid i-Zone instant camera, and the Palm V to the "fat" toothbrush for kids and a self-sealing water bottle for dirt bikers. Not surprisingly, companies all over the world have long wondered what they could learn from IDEO, to come up with better ideas for their own products, services, and operations. In this terrific book from IDEO general manager Tom Kelley (brother of founder David Kelley), IDEO finally delivers--but thankfully not in the step-by-step, flow-chart-filled "process speak" of most how-you-can-do-what-we-do business books. Sure, there are some good bulleted lists to be found here--such as the secrets of successful brainstorming, the qualities of "hot

teams," and, toward the end, 10 key ingredients for "How to Create Great Products and Services," including "One Click Is Better Than Two" (the simpler, the better) and "Goof Proof" (no bugs). But The Art of Innovation really teaches indirectly (not to mention enlightens and entertains) by telling great stories--mainly, of how the best ideas for creating or improving products or processes come not from laboriously organized focus groups, but from keen observations of how regular people work and play on a daily basis. On nearly every page, we learn the backstories of some now-well-established consumer goods, from recent inventions like the Palm Pilot and the in-car beverage holder to things we nearly take for granted--like Ivory soap (created when a P&G worker went to lunch without turning off his soap mixer, and returned to discover his batch overwhipped into 99.44 percent buoyancy) and Kleenex, which transcended its original purpose as a cosmetics remover when people started using the soft paper to wipe and blow their noses. Best of all, Kelley opens wide the doors to IDEO's vibrant, sometimes wacky office environment, and takes us on a vivid tour of how staffers tackle a design challenge: they start not with their ideas of what a new product should offer, but with the existing gaps of need, convenience, and pleasure with which people live on a daily basis, and that IDEO should fill. (Hence, a one-piece chil-

dren's fishing rod that spares fathers the embarrassment of not knowing how to teach their kids to fish, or Crest toothpaste tubes that don't "gunk up" at the mouth.)

- Granted, some of their ideas--like the crucial process of "prototyping," or incorporating dummy drafts of the actual product into the planning, to work out bugs as you go--lend themselves more easily to the making of actual things than to the more common organizational challenge of streamlining services or operations. But, if this big book of bright ideas doesn't get you thinking of how to build a better mousetrap for everything from your whole business process to your personal filing system, you probably deserve to be stuck with the mousetrap you already have. --Timothy Murphy

9. *Strategy for Sustainability*

- *Werbach*

This is the definitive work on business strategy for sustainability by the most authoritative voice in the conversation.

More than ever before, consumers, employees, and investors share a common purpose and a passion for companies that do well by doing good. So any strategy without sustainability at its core is just plain irresponsible - bad for business, bad for shareholders, bad

for the environment. These challenges represent unprecedented opportunities for big brands - such as Clorox, Dell, Toyota, Procter & Gamble, Nike, and Wal-Mart - that are implementing integral, rather than tangential, strategies for sustainability. What these companies are doing illuminates the book's practical framework for change, which involves engaging employees, using transparency as a business tool, and reaping the rewards of a networked organizational structure.

Leave your quaint notions of corporate social responsibility and environmentalism behind. Werbach is starting a whole new dialogue around sustainability of enterprise and life as we know it in organizations and individuals. Sustainability is now a true competitive strategic advantage, and building it into the core of your business is the only means to ensure that your company - and your world - will survive.

In Strategy for Sustainability, Adam Werbach shows us how sustainability moves beyond compliance-oriented green initiatives to become a key strategy for achieving both competitive advantage and meaningful change. By integrating a systems perspective into business practice and priorities, Werbach lays out a compelling new model for building core business strategy.

10. *In the Bubble*

- John Thackara

We're filling up the world with technology and devices, but we've lost sight of an important question: What is this stuff for? What value does it add to our lives? So asks author John Thackara in his new book, In the Bubble: Designing for a Complex World. These are tough questions for the pushers of technology to answer. Our economic system is centered on technology, so it would be no small matter if "tech" ceased to be an end-in-itself in our daily lives. Technology is not going to go away, but the time to discuss the end it will serve is before we deploy it, not after. We need to ask what purpose will be served by the broadband communications, smart materials, wearable computing, and connected appliances that we're unleashing upon the world. We need to ask what impact all this stuff will have on our daily lives. Who will look after it, and how? In the Bubble is about a world based less on stuff and more on people. Thackara describes a transformation that is taking place now—not in a remote science fiction future; it's not about, as he puts it, "the schlock of the new" but about radical innovation already emerging in daily life. We are regaining respect for what people can do that technology can't. In the Bubble describes services designed to help people carry out daily activities in new

ways. Many of these services involve technology—ranging from body implants to wide-bodied jets. But objects and systems play a supporting role in a people-centered world. The design focus is on services, not things. And new principles—above all, lightness—inform the way these services are designed and used. At the heart of In the Bubble is a belief, informed by a wealth of real-world examples, that ethics and responsibility can inform design decisions without impeding social and technical innovation.

11. *The Nature of change or the Law of Unintended Consequences*

- John Mansfield

This absorbing book provides a broad introduction to the surprising nature of change, and explains how the Law of Unintended Consequences arises from the waves of change following one simple change. Change is a constant topic of discussion, whether be it on climate, politics, technology, or any of the many other changes in our lives. However, does anyone truly understand what change is? Over time, mankind has deliberately built social and technology based systems that are goal-directed there are goals to achieve and requirements to be met. Building such systems is man's way of planning for the future, and these plans are based on predict-

ing the behavior of the system and its environment, at specified times in the future. Unfortunately, in a truly complex social or technical environment, this planned predictability can break down into a morass of surprising and unexpected consequences. Such unpredictability stems from the propagation of the effects of change through the influence of one event on another. The Nature of Change explains in detail the mechanism of change and will serve as an introduction to complex systems, or as complementary reading for systems engineering.

12. *Visual Tools for Transforming Information into Knowledge*

- David Hyerle

This book discusses the value visual mapping: brainstorming, graphic organizers, and concept mapping and offers suggestions for student use. More importantly, the book validates these visual maps with research, software references, and other authors and books. It's a great way to map student thinking and if done correctly, students can transfer the skills when needed. The author relies less on reproducible orangizers and more on student-centered products in conjunction with questions, collaborating and evaluating. A good resource for a team to tackle interdisciplinary units. Additionally, the author demonstrates visual mapping uses in the business

world and on a district or school level. Great staff development idea.

13. *Article: Innovation, growth, and Getting to Where you Want*

- Ryan Jacoby, Diego Rodriguez, Business factors Consultants, IDEO

Design thinking is a crucial business asset—one that can, indeed, move a company forward and improve the bottom line. To optimize this impact, Ryan Jacoby and Diego Rodriguez advise thoughtfully structuring the innovation process. They stress working on projects that improve people's lives, and they present a "ways to grow"model that helps managers direct and assess innovation efforts.

14. *Paper: Toward Human Centered Innovation*

- Lewis J. Perelman

In regard to efforts on accelerating innovation—and particularly the project on Innovation's Vital Signs—there should be a greater focus on human -centered innovation , for at least two reasons. First, change and innovation are not desirable ends in themselves; in fact, some innovation is evidently wasteful and even destructive. Second, while further research is needed to determine the detailed nature of the trend, current business news strongly suggests that the leading edge of innovation today is

increasingly driven by human-centered design. This trend challenges much of the conventional wisdom underlying both public-sector and private, philanthropic efforts to promote innovation as a general economic good. Such efforts in many cases should be re- thought and adjusted to account for more than just the inputs to innovation, or the gross level of resulting innovation activity. Rather, initiatives to promote innovation need to assess and consider the net social value of the resulting outcomes.

15. *Paper: Unintended and Undesirable consequences of Innovation*

- Karl-Erik Sveiby, Pernilla Gripenberg, Beata Segercrantz, Andreas Eriksson, Alexander Aminoff

Although innovation is one of the most commonly mentioned concepts in social science unintended undesirable consequences of innovation are rarely studied. This study does a literature review of all articles in the EBSCO database, with innovation in the title and which study undesirable consequences. We found only 26 such articles; 1 per 1000, a proportion that has not changed since the 1960's. An author survey on why there is still so little research on this issue was therefore also done and is presented. The survey ranks suggested hypotheses and finds that the most important

limiting factors are pro-innovation bias among researchers and vested interests of funding agencies, which cause change agents and researchers to consider mainly an innovation's intended desirable consequences. A theoretical framework for studying undesirable consequences of innovation based on diffusion theory, Robert Merton's sociology and stakeholder theory is developed and applied on the selection of articles. A combination of the two analyses suggests a separation of discourses. Unintended and undesirable consequences of innovations are discussed in other scientific discourses and with other theoretical frameworks. We argue that the current separation of discourses is potentially dangerous for society as a whole.

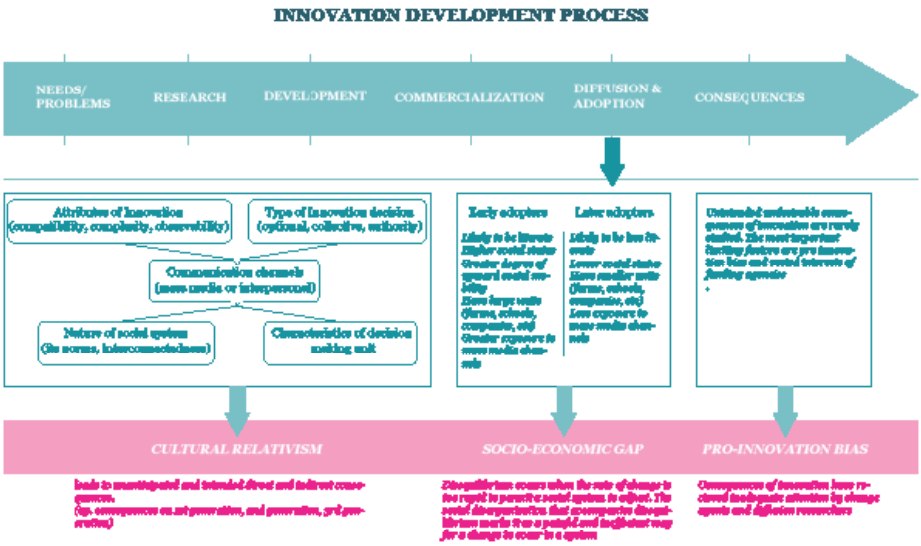
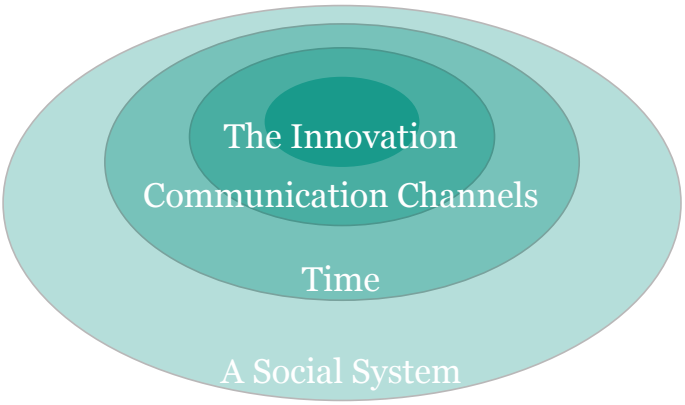


FIG. 1 INNOVATION DEVELOPMENT PROCESS



Main Elements in the Diffusion of Innovations

FIG. 2 DIFFUSION OF INNOVATIONS

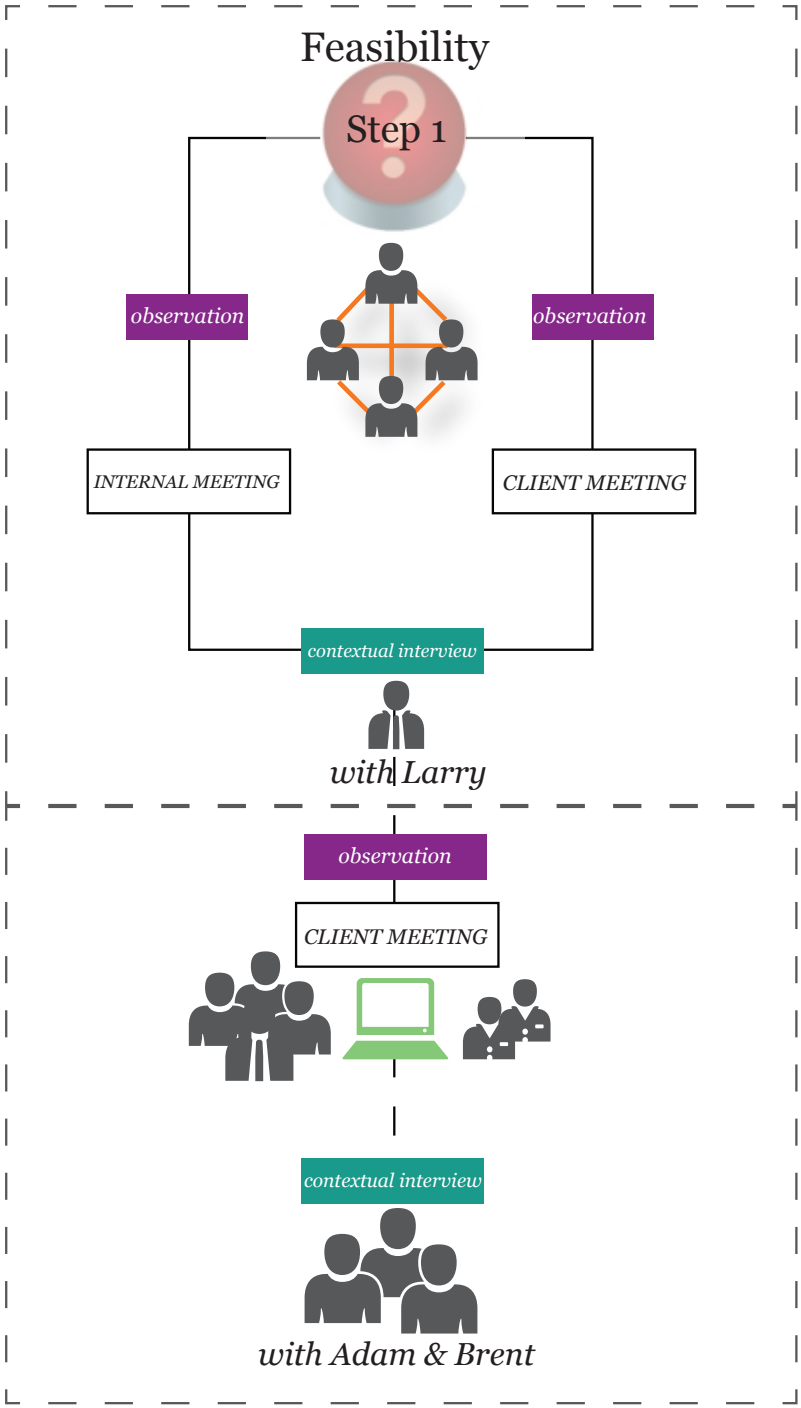


FIG. 3 RESEARCH METHODOLOGY

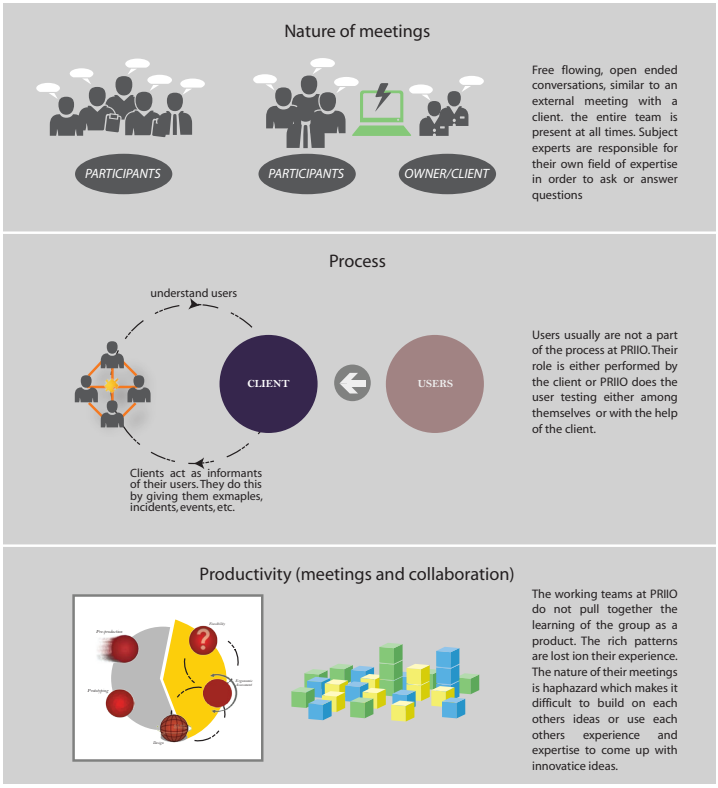


FIG. 4 ANALYSIS BASED ON THEIR NATURE OF MEETINGS, PROCESS AND THEIR PRODUCTIVITY

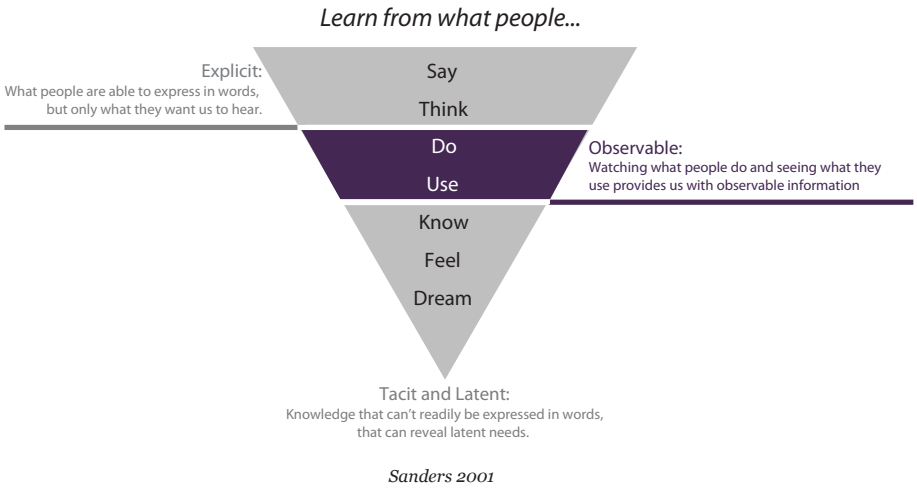


FIG. 5 LIZ SANDERS_LEARN FROM WHAT PEOPLE..

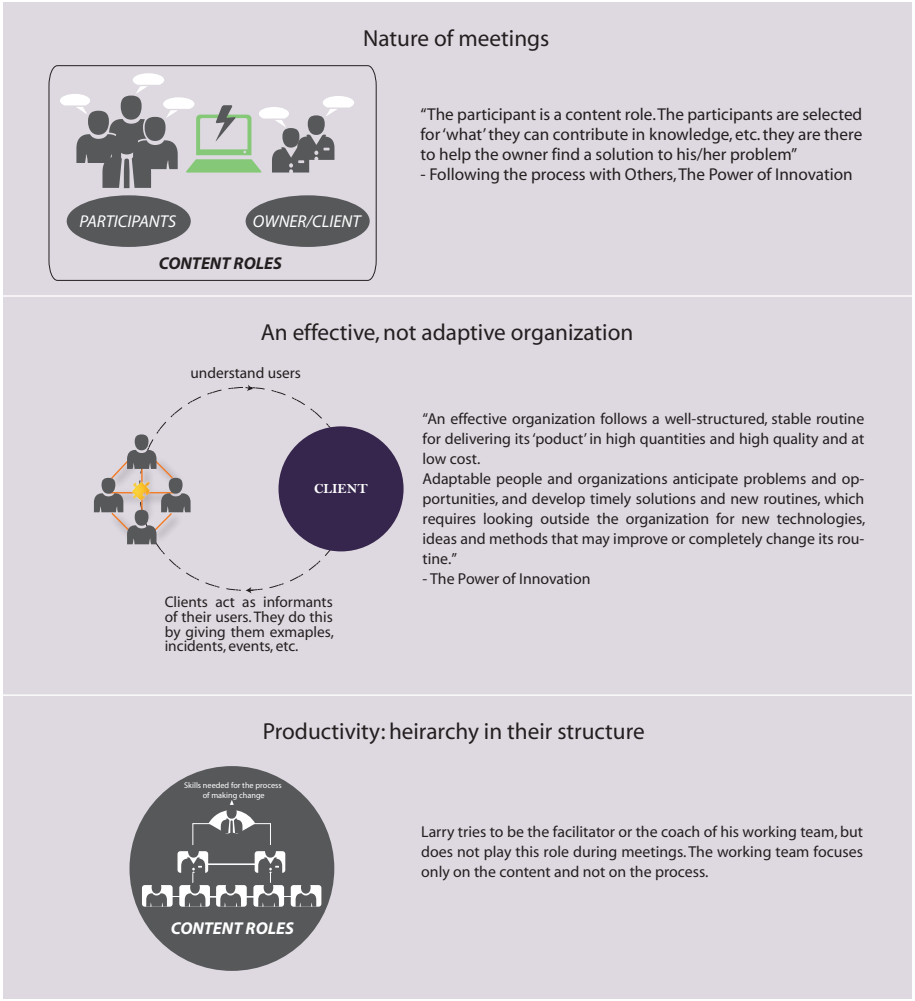


FIG. 6 ANALYSIS BASED IN LIZ SANDERS FRAMEWORK

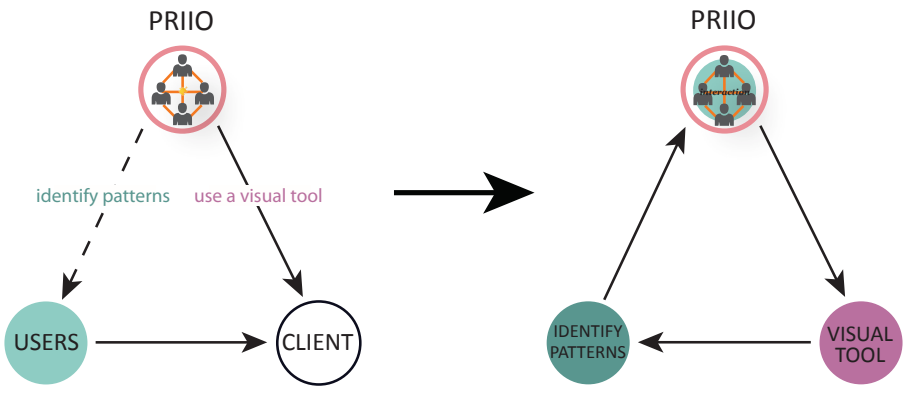
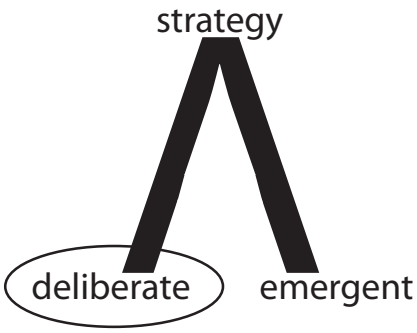


FIG. 7 SHIFT IN FOCUS



"In practice, all strategy making walks on two feet, one deliberate, the other emergent. For just as purely deliberate strategy making precludes learning, so purely emergent strategy making precludes control. Pushed to the limit, neither approach makes much sense. Learning must be coupled with control. "

Mintzberg, Henry. "Crafting Strategy." Pp. 161 in J. S. Ott (Ed.),

FIG. 8 DELIBERATE AND EMERGENT STRATEGY

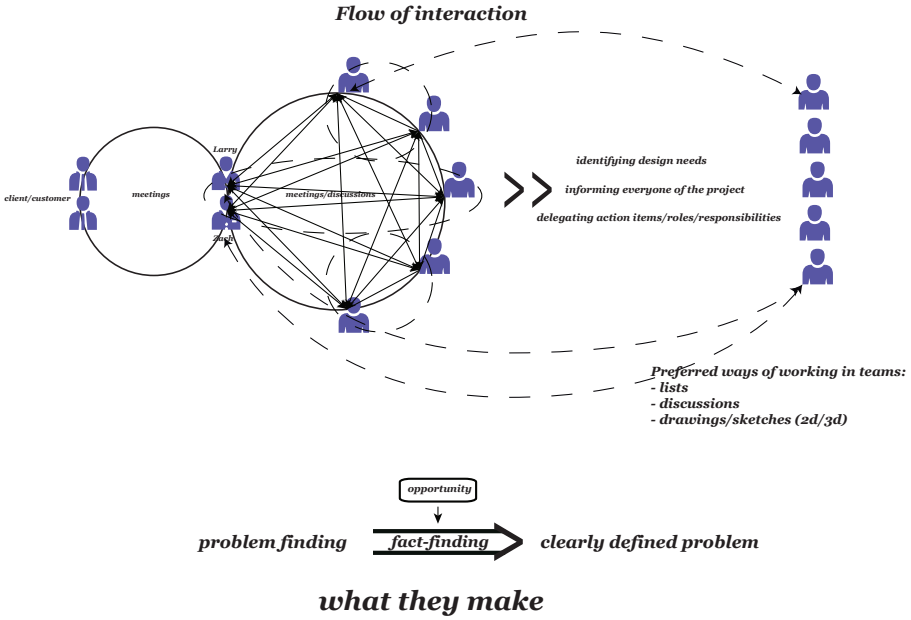


FIG. 9 ANALYSIS BASED ON THE ARTIFACTS CREATED BY THE PARTICIPANTS

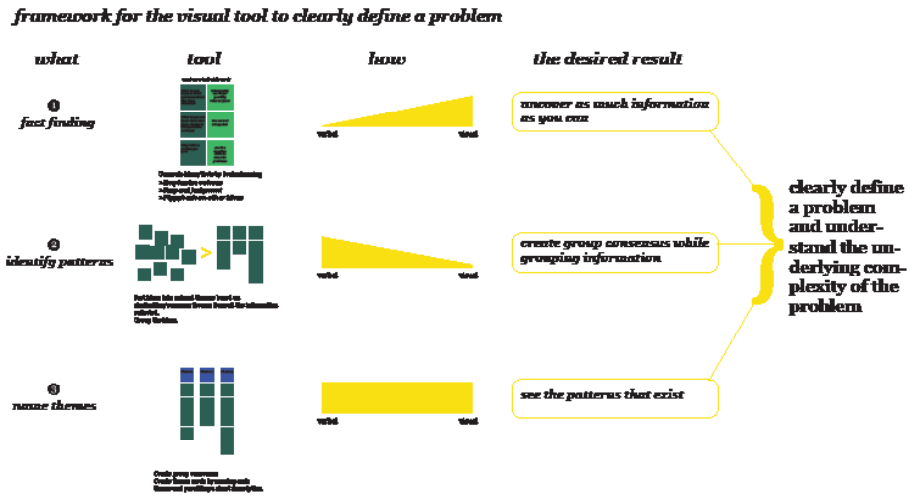


FIG. 10 VISUAL TOOL AND ITS FRAMEWORK

FIG. 11 WORKSHOP AT PRIIO

FIG. 12 PARTICIPANTS FILLING OUT THE QUESTIONNAIRE

FIG. 13 PARTICIPANTS MAKING THEIR EXPERIENCE OF FLOW OF INTERACTION BETWEEN TEAM MEMBERS DURING THE INITIAL PHASE OF A PROJECT

FIG. 14 DATA COLLECTED THEIR EXPERIENCES OF FLOW OF INTERACTION BETWEEN TEAM MEMBERS DURING THE INITIAL PHASE OF A PROJECT

FIG. 15 ARTIFACTS MADE BY THE PARTICIPANTS

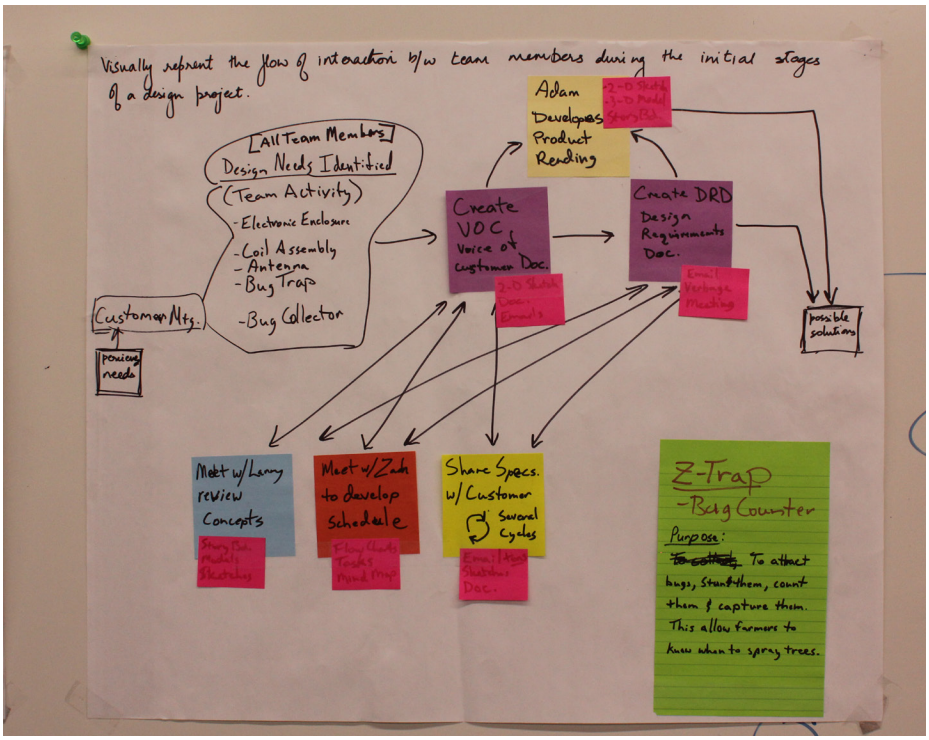


FIG. 16 ARTIFACTS MADE BY THE PARTICIPANTS

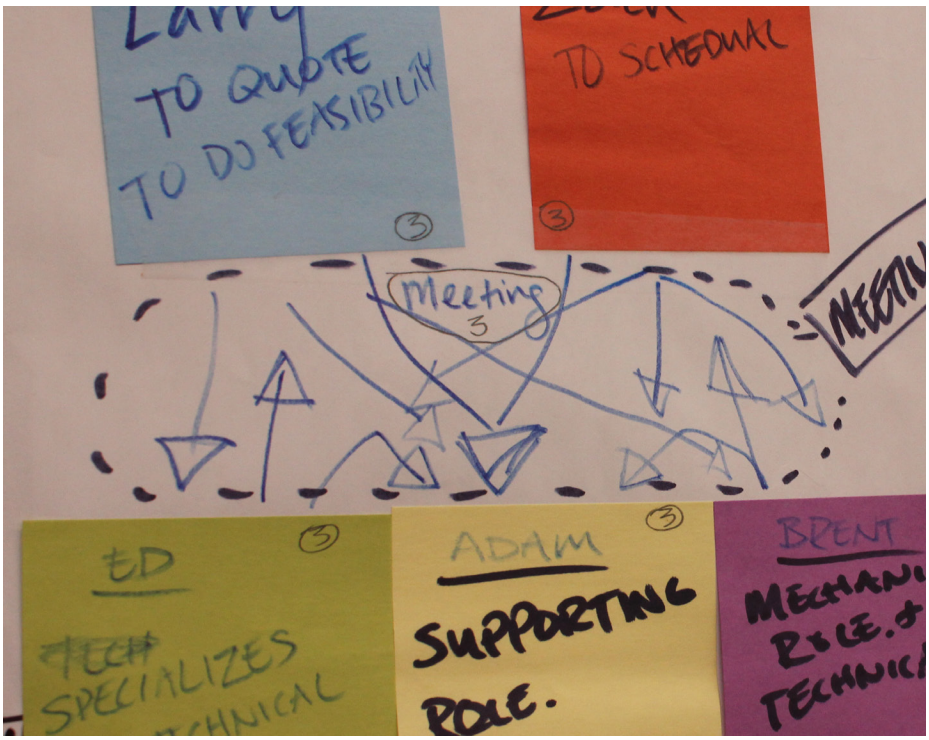


FIG. 17 IDENTIFIED OPPORTUNITY WITHIN THE PARTICIPANTS DATA THAT WAS COLLECTED

FIG. 18 IDENTIFIED OPPORTUNITY WITHIN THE PARTICIPANTS DATA THAT WAS COLLECTED

FIG. 19 WORKING TEAM AT PRIIO USING AND TESTING THE VISUAL TOOL TO IDNETIFY PATTERNS

FIG. 20 WORKING TEAM AT PRIIO USING AND TESTING THE VISUAL TOOL TO IDNETIFY PATTERNS