



Big Picture Thinkers in Industry—Who Are They?

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Abstract. Driving a breakthrough mindset is a critical step for realization of innovation for continued business success and growth. The goal of this paper is to begin characterizing one attribute we believe plays a role in driving a breakthrough mindset—big picture thinking: an ability to see the challenges and opportunities associated with multi-level interactions, interrelationships and interdependencies that are technical, social, and temporal within and surrounding the scope and responsibilities of the individual. Those who can see and leverage this “big picture” we refer to as *Big Picture Thinkers* (BPT). In the corporate environment, there is significant concern over the loss of BPT due to the retirement of Baby Boomer generation engineers. In the academic environment, the development of BPT aligns with efforts to prepare engineers who can work and innovate across disciplines although it may run counter to efforts to develop engineers with specialized expertise. There is little empirical research on the skills, behaviors, and values of BPT in technology-based industries. Research is needed to develop a language of BPT that can guide professional development in the workforce and in academia, as well as to understand the ways BPT are critical to driving a breakthrough mindset. In this paper we present preliminary findings from a two-phase research project on characteristics of BPT conducted within a Fortune 500 Consumer Packaged Goods (CPG) multi-national company. The aim of this research is to support ways to capture technical knowledge in industry and enable the transfer of this knowledge to the next generation of professionals.

Background

In today’s organizations, human capital, and the potential it brings in terms of expert knowledge, efficiency, and insight,¹ is more important than traditional assets such as equipment, facilities or natural resources.² Organizations that see themselves as “knowledge-generating communities must continually determine what they know and do not know, find ways to efficiently share what they know among their members, and create or acquire knowledge they lack.”³ A common and persistent theme in the literature on critical engineering workforce issues is the need to address the loss of technical expertise mainly due to retirement.^{4,5,6}

Scholarly research in engineering education rests on the ability of researchers to create field-shaping knowledge to rethink the boundaries of engineering. Re-imagining engineering and engineering education requires carefully considering the entire spectrum of education and practice, from pre-school programs to higher education and beyond to include the study of the practice of engineering. Studying the practice of engineering is insightful when one understands that research in engineering education should tackle the big question of how engineering is best learned, taught, and practiced. Therefore, this paper in this division of the ASEE Annual Conference, College-Industry Partnership (CIP), addresses one of the special needs of industry that is specifically related to the critical issue of the loss of massive amounts of experience due to the retirement of Baby Boomer generation engineers. Engineers learn by practicing on site just as they learn in the controlled environment of the classroom. Studying how engineers learn by practicing on site is necessary to capture their unique expertise, and to accelerate the

development of a new generation of engineers. This paper focuses on one aspect of this expertise: big picture thinking.

The ability to drive a breakthrough mindset is one kind of human capital believed to be essential for strategic global business innovation and the shaping of innovative work environments and culture. Components of a breakthrough mindset are associated with market learning,⁷ counterintuitive innovative thinking,⁸ and an ability to think and work across perspectives or organizational functions.⁹ Driving a breakthrough mindset is also likely to involve an ability to see the challenges and opportunities associated with multi-level interactions, interrelationships and interdependencies that are technical, social, and temporal within and beyond an individual's job responsibilities. Individuals who can see and leverage this "big picture" to shape both products and the companies in which they work, we refer to as *Big Picture Thinkers* (BPT).

Definitions for holistic systems thinking, which seems to be related to "big picture" thinking, diverge; however, there seems to be remarkable commonalities on mechanisms that enable and obstruct the development of this kind of thinking.¹⁰ The lack of a substantial empirical research on the development of BPT individuals in the workplace is the main motivation for this study; however, we assert BPT is also important for understanding critical issues for the academic preparation of engineers for the workforce of tomorrow. Based on prior research in the areas of design thinking and cross-disciplinary thinking,¹¹ we assert that BPT can be (1) investigated and characterized as ways of thinking, doing, and being; (2) understood as a kind of expertise developed through experience, considerable practice, and dispositions that motivate engaging in particular kinds of experiences; and (3) nurtured (as well as discouraged) in the work place via organizational structures, policies, and culture. This motivated the two research questions guiding this project:

- What are the characteristics of BPT professionals, and what are their qualifications?
- How is big picture thinking acquired?

This study has two phases. In the first phase, the focus is on the first research question and involves the use of semi-structured interview methods to elicit the knowledge associated with the experiences of a strategically selected group of participants representative of expert BPT thinking and its development. The interview questions emphasize prior experiences, motivations, training and mentoring experiences, work history, and a short list of self-identified "breakthrough" accomplishments. We use qualitative methods to identify themes from the interviews. These themes will be used to generate questions for a survey that will be distributed more broadly within the organization, including a subset of approximately 30 strategically selected individuals that are representative of BPT or indicative as "promising" in developing as BPT. Themes will be further tested through a second set of interviews with these 30 strategically selected individuals. The second research question is the focus of the second phase of this study. The project is still on-going; only preliminary results from Phase 1 are reported in this paper.

Method

This study explores the qualities of big picture thinkers in industry based on their experiences and accomplishments. We use grounded theory as a qualitative mode of inquiry to investigate the

different experiences of a strategically selected group of participants in order to understand the nature of big picture thinking. Grounded theory is one kind of qualitative research. It aims to build a theory that is derived from data, systematically gathered and analyzed through the research process. As one of the pros of this approach, “theory derived from data is more likely to resemble the “reality” than is theory derived by putting together a series of concepts based on experience or solely through speculation.”¹² Details regarding participants, data collection and management, and data analysis are provided in the paragraphs below.

Participants. The participants were four senior technical leaders in a Fortune 500 CPG multinational company, which is also the company that funded this research. In this paper, the participants are given the names Andrew, Ben, Chris, and Don. They were selected by a company champion based on their track record of BPT accomplishments as well as their roles and responsibilities within the company as individuals whose decisions not only shape the company’s products, but also shape the future of the company. In a later phase, a larger, more diverse sample from among 30 strategically selected expert and promising BPT will be recruited to confirm themes.

Data collection and management. First, data were collected through a one-hour focus group discussion with the four participants to elicit perspectives on big picture thinking. This helped shape the design of the interview protocol that was later used individually with each participant. The interview protocol was based on the Critical Decision Method (CDM) for eliciting expert tacit knowledge.¹³ This method is appropriate for studying BPT because of its effectiveness at characterizing “the context of the larger environment of which [a system] is a part” and the importance of the “role it plays in the larger whole.”¹⁴ We use a semi-structured format with follow-up probes to help the interviewee reflect on their insights, strategies, and basis for decisions, judgments, or courses of action.¹⁵ Probes were used to ask participants to expand on the meaning of certain ideas such as “broad background.” The interview lasted one hour and the protocol had three sections: a section on background and influential experiences; a section on the critical decision method; and a section on questions about experiences with developing and identifying other big picture thinkers. Following the individual interviews, a second one-hour focus group discussion was used to follow up on certain concepts brought up from the individual interviews. The focus groups and interviews were transcribed for later analysis.

Data analysis. The analysis involved repetitive reading of each transcript among the authors, as a whole and later focusing on significant sections that connected across transcripts. Having both authors check and re-check themes allowed iterative testing of themes substantiated through evidence. The outcome of this process was the identification of (1) qualities of BPT (both for early indicators and track record); and (2) dispositions, motivations, and experiences (formal and informal) associated with those qualities.

Results

In the following paragraphs, we present the five qualities of BPT that emerged consistently through the data, with evidence from the interviews to substantiate themes within and across participants. Indented text with quotes is used to signify long excerpts from the interviews.

Quality 1: Challenging the status quo

The theme of *challenging the status quo* illustrates the *ability to push in new directions which are non-traditional and not necessarily obvious, with the anticipation of resistance but with determined persistence to challenging the status quo*. This involves (1) **critiquing** the current situation with the motivation of doing something new or doing something differently; (2) understanding the dynamics of **support and resistance** in the organization; and (3) the tendency of going **beyond the scope of normal, defined responsibilities**. Big picture thinkers who exhibit this quality focus on asking questions about the scope of the work. They have had experiences around challenging the assumptions of the way things have been traditionally approached; seeing deficiencies in fragmented approaches that others could not see; and foreseeing the consequence of actions from multiple perspectives. This suggests that challenging the status quo often involves interactions with people who may resist change. For Andrew, there is an element of benefit when people “value your perspective” and engage with a BPT in this kind of “divergent mode of really trying to figure out opportunities.” But at the same time there are elements of dissatisfaction:

“The not so satisfying elements are probably related to that side of development that really starts to be the implementation. People, I think, probably tend to see a big picture thinker as a distraction. As you know, your head is in the cloud; you are not relevant to the problem that I’m dealing with; you are just creating more problems for us. So, I think that there is that perception of big picture thinkers that can have that kind of a feel—in many companies what turns out to be a fairly large portion of R&D.” [Andrew]

Similarly, Ben notes that “many other people are happy that they’re into the project; they’re executing it, they’re going through the steps that they need to go through. They’re not stepping back to look at it.” Yet, he emphasizes the need for someone to critique a traditional approach to make sure that the “basic proposition is really good and really sound.” Ben elaborates on making colleagues, particularly those who are good executors, aware that they are on the “right direction before they get going because they’ll never look up again once they start.” He illustrates this point with the following example where he considers his reactions were challenging the status quo:

“So after we decided it was going to be this new technology they were going to put it in without a control room. They were going to put in stations on the operating floor. And I said guys; you’ve got to be crazy. I mean, how could you possibly do that? You have to put a control room in. Well, it’s not in the budget and so we don’t have that – that doesn’t make any difference. I say you have to do it and, and besides it will improve the communication within the, the crews and stuff because you’ll be able to sit in a quiet place and talk. When you have a problem you’ll be able to talk through what’s going on and decide what you’re doing instead of shouting at each other, on the operating floor in all the noise.” [Ben]

For Chris, critiquing is intertwined with understanding the dynamics of the teams involved. He mentions that, “I think people gave me the opportunity to think, so I just think the way I think. I don’t know if I got it from anybody.” He then describes how he wanted to offer the same opportunity for people who work with him. He describes the situation of a brilliant senior scientist who always comes up with ideas that do not make it to production. “I sort of decided that I’m going to make it my mission that I’m going to help him push one through. You know, whatever it takes, just figure it out – let’s pick one and figure out how to make it happen,” Chris elaborates on this example, where he supported someone to move an idea forward. In contrast, Don provides the following relevant insight of experiencing resistance:

“We definitely have headwinds. Pushbacks, to a degree. Part of it is this takes time and it takes effort. There’s always gonna be a push to do it quicker, to simplify and deliver outside of what your projected timeline is. Um, so that’s part of it. Um, also turf issues, which I don’t think you find too surprising being in an academic environment. They exist in industry as well. Um, and there also – as we bring new groups in and there’s this – this period of transition, um, there are many influences on the new team they often struggle to budget time and set up the appropriate plans.” [Don]

Chris provides another example in a meeting where he suggested a new direction and was not sure if it was accepted just because of his seniority:

“And, so I’m asking that question, why aren’t we considering that? And they added it to the scope because of the discussion. And I don’t know if it’s for my level or things like that, why it was accepted. But – so I went and talked to some people that had been working on the project, and I told them, yeah, we got this thing added to the scope. And they’re like, oh, thank god. I’ve been telling them this for weeks; that was the way to go.” [Chris]

Don asserts that there are “multiple opportunities to make the business successful.” Therefore, there is the need to continually challenge current practice or perspectives: “if you only look at one area, you run the risk of becoming irrelevant. You need to continually examine what the marketplace is doing, where the consumer is going.” This does not happen without a BPT who pushes out beyond traditional scope of responsibilities:

“A big picture thinker goes beyond what I would say is their normal scope of responsibilities – their normal sphere of influence, and actively includes inputs and connections that extend beyond define a scope of responsibility, including unrelated influences and experiences that aren’t necessarily focused on their scope of responsibilities. A Big Picture thinker pushes out their scope of responsibilities by the nature of their work approach.” [Don]

One of the ways people challenge the status quo is to take an outsider perspective. The individual who thinks about the big picture often times is comfortable presenting an outsider perspective:

“I think it goes beyond the individuals that we would say would be big picture thinkers. It’s kind of a practice that, in some cases is formal and encouraged by the corporation, and in other cases it is more of an individual effort to go out and make the awareness of what’s going on in other sectors. And, occasionally, it is happenstance.”[Don]

“The thing that comes to my mind is this notion of almost being an outsider. And being comfortable not being an insider, not being part of the common thought process, and willing to be separate and have your own perspective, your own view, and then if people come to that, great. But being okay with, with that notion of being an outsider. And maybe even to the point of once people come to follow that particular path or something, then looking for when is the next time I can be an outsider? You know, what’s the next thing that I need to be an outsider on.” [Andrew]

Quality 2: Seeing patterns and making connections

Where the first quality of challenging the status quo focuses on suggesting new directions, the second quality focuses on *connecting across perspectives, bridging diverse approaches and thoughts for new insights, and seeing patterns that are not easily visible in unstructured situations*. This involves (1) reflecting on **past opportunities, experiences and exposures**, broad as well as specialized, that provided a repertoire that can be drawn upon for unexpected connections; (2) effectively **connecting seemingly unrelated concepts or ideas** from within or between different areas; and (3) **foreseeing far opportunities** and forecasting possible interactions and interrelationships that are not easily visible in the current situation. Alternatively, these themes can be understood as (1) *past opportunities*; (2) *present, or near future*, integrative thinking; and (3) *future strategic vision*. A common feature of big picture thinkers in this study is that when they make connections, they connect science or technology perspectives *with* business or marketing perspectives *and* customer perspectives.

Ben describes his background as “unique” because he went to “a liberal arts engineering program” where he “went three years there and did a lot of liberal arts stuff and followed a physics major for [two] years, and then transferred to an engineering school.” In addition, Ben describes his early interest in what he calls “a process”:

“Growing up, I always loved [what] I called it process. I mean I would draw pictures, I think I still have it somewhere at home file, probably as a nine-year old. I would draw pictures of things like, pigs in a field on one side of the picture and then there would be a wall and there would be this factory with sausages coming out the other side. And it would show all the different things that were happening inside the factory, this process. [Ben]

At the same time, Ben demonstrates the intentional learner quality to develop understanding of connections between ideas. He reflects back on his early fascination to deeply understand “how things were made.” He characterizes this as a “sense of wonderment” to know why something doesn’t break! Combined with that is his wide range of interests:

“... going to museums, any historical thing and just trying to absorb all the information. Because I, I love trying to sort of put the pieces together and say okay, I get now how that happened in some historical event or, um, you know some sequence of things in history, or a science museum ... It doesn’t matter. I mean I, I just, I’m the guy that reads all the plaques, all the things very slowly and is trying to reread them and make sense of it” [Ben]

Before transferring to an undergraduate engineering program, Ben took an opportunity that allowed him to “understand the difference between the things.” When he got to engineering “it made a lot more sense” and he was able to “learn more effectively” because he actually had “internalized some of that working knowledge.” Ben, however, describes himself as a “slow learner;” he felt that he was “behind other people in terms of grasping concepts and stuff.” But he also realized that what he learned he didn’t forget:

“I think naturally sometimes I’ll say something that’s referring back to like a something that I learned in school 30 years ago and people say how can you remember that? I don’t know I guess I learned it well” [Ben]

Ben suggests that this kind of “background probably helps more with an abstract thinking and kind of, drawing things together, in a later or in an unstructured environment.”

Don, whose past experiences included getting a Ph.D., describes how the way his advisor mentored him made a profound impact on him. His advisor himself had a broad background and had “expectations that his students develop breadth as well as depth.” Don describes the habit of making connections between things as something he does frequently as an integral part of his way of thinking:

“I do it at the job; I do it when I’m not at the job, at home or, you know, out and about and looking at things. In Columbia, the consumer’s different, the store setup’s different. It’s an education every time I go out and go to a restaurant or go to grocery shopping. But I think it’s also things that many researchers do ... I have a couple of information feeds that come in, national labs, NASA, R&D newsletters, things that go on in medical research, biological researches, aerospace, automotive. They’re not directly applicable to what we do, but the technology, the developments that are going on there may at some point be applicable. They, at least, are kind of leading edge technology areas that let you know what’s possible, what could be available in the future, and it’s just interesting.” [Don]

Similarly, to Chris people who are technically “very narrow and deep in certain areas are critical to the process” and are not “going [to] make the big connections because they just don’t see enough of the puzzle.” Chris describes how he puts himself in the pathway of diverse information:

“Well, it obviously varies, by organization. For me, it could be formal, it could be informal. There are certain meetings that I make sure I’m in, which for example, things like – where we will go through our whole portfolio of projects. I’ll definitely want to be in those, and meetings where we’re defining and agreeing on the technical scope for a new project. I’ll be in those because I might point out that, hey; did you think about this or that? I ask those questions. Meetings where we’re talking about end user customer needs. I’ll usually try to be in those. And then I do a lot of informal, just talking to various people within the department, and I’ll make trips to and talk to those people.” [Chris]

Chris characterizes people who are big picture thinkers as ones who can understand new concepts very quickly, because they are able to make connections and see patterns more easily compared to others:

“I’ll usually identify someone as kind of having that capability. When you’re trying to explain something, they just really quickly know where you’re going with that. They just – they’re just very quick on the uptake on something new, understanding something.” [Chris]

Foreseeing the future and connecting forward are also themes of big picture thinking. To Andrew, big picture thinking has “this notion of connecting outward rather than focusing inward.” Andrew notes that there is a sense of satisfaction when you engage in divergent thinking with others, trying to forecast the future or describe the future:

“I think the benefits are that I think that people value your perspective. They want to engage with you when they are in kind of this divergent mode of really trying to figure out opportunities. I think whether it’s the business units, whether it’s the corporate technology groups, that perspective and bringing in those new thought ideas, bringing in a different perspective is a valued role in at least the early stages of research and engineering. So I think that’s a benefit. I think also personally, it’s quite a satisfying; it’s quite satisfying as well in terms of making you feel as though you’re trying to identify what are those big opportunities for the company or for the world.” [Andrew]

However, associated with that is sometimes a lack of appreciation for big picture thinking, because of the large gap between foreseeing an opportunity and actually implementing it:

“Often the people who had that original idea, who saw that original opportunity, 5 or 6, or 7 or 10 years later, once we actually get it into the market and are making money out of it; those original people are long forgotten. And so in some ways, it

almost requires somebody who needs that very tangible reward of being able to see the progress on a day to day basis. You know, somebody who needs that and that's an important element of what they do, probably is going to tend to not move too much into this big picture route. Because they need to say hey, I went and ran this manufacturing trial or I went and ran this experiment and now I see this tangible result and I see the next step moving forward. A lot of this big picture thinking, those kind of opportunities to see a reward form that can be months or years between steps.” [Andrew]

Overall, the quality of seeing patterns and making connections appears to be related to a motivation to cultivate transformative practice:

“It's kind of combining technology, business results, and consumer behavior in one sort of analysis, if you like. And then, from that, drawing a conclusion that leads you to a course of action, which you recognize now as useful, based on that insight. And then translating it to another business, which where you believe it would also be relevant.” [Ben]

“I think people that I looked to and consider big picture thinkers probably have more diverse information streams coming into them than people that I would not consider big picture thinkers ... A number of my co-worker are very deep, very focused, subject matter experts, they continually look for and try to improve their knowledge base around the thing that they're passionate about. I think a big picture thinker has a passion to bring in more diverse information and is either interested in or has an inherent capability of making connections ... they're more intuitive about their approach to things, so they can make leaps and make those connections where it may not be apparent or visible to a lot of other people, whether they're big picture thinkers or not. But it's a basis of the type of information, the amount of information and the ability to see things that allow your intuition to make associations that, lead to kind of those a-ha moments.” [Don]

Quality 3: Painting a picture

Where the previous quality of *seeing patterns and making connections* focuses on “seeing” a new direction, the third quality focuses on “painting” this new direction for others to see and value. Painting a picture involves making visible invisible opportunities that *broaden the scope of a discussion as well as persuading and delivering confidence and value in a new direction*. This involves (1) **clarifying and simplifying** complex situations to reground people in new realities; (2) **developing awareness** and bringing into the line of sight new understanding of facts; and (3) **delivering confidence** in a new direction through effective persuasion and compelling stories. All of these themes share one common feature—the ability to tackle the difficulty of convincing others when the circumstances of changing direction are unclear, uncertain and uncomfortable. Chris explains that when he suggests a new direction in such situations, he asks, “Why isn't this [the] scope?” He notes that, “no one could give a good reason ... It's kind of creating an

abundance mentality. I didn't cause them to say, hey, we're gonna change the scope. I didn't cause them to say we're going to depart from this." Instead, Chris tries to build ownership around an idea - "it's like why would you not want to do that; you gotta try to make things—it's like the old Dale Carnegie thing, help the other fellow feel like it's their idea."

One way to develop awareness is to engage multiple perspectives. For Don, when multiple stakeholders, "internal technology teams, business, marketing, product supply, research and engineering," engage in a discussion, "we call our core team" which "usually has a representative from most of those areas that acts as a contributor to the development of our future planning activities and as an ambassador back to their organizations." Don explains that this is essential "to keep those organizations informed at a high level" so that "the organization's interests are being identified and addressed and the effort is moving forward effectively". All of these strategies create lines of communication and shared ownership that can help a new idea take hold and counteract pushbacks:

"Successful examples are useful and show that there is a path along the process that we've identified to concentrate on ... The balance between letting them know that this is something that's in conflict with the process [is] not an appropriate issue. So it's communication – communication, but also allowing some of it to happen so that the experience then teaches a lesson. We're advising and, consulting with these groups, based on past experience as well as some judgment" [Don]

Delivering confidence can involve convincing others about new directions, as Andrew explains: "We have some ability to do some things whether [others say] I agree with you or not." But the challenging part, Andrew adds, "has been the little bit lack of support that we have seen from some of our colleagues. That's, I think, been a challenge or a frustration." Ben suggests "sort of selling the idea based on an understanding of what the consequences would be" as one way to overcome this challenge. Ben says he gets excited about "explaining stuff to people. I really like teaching. I like explaining. You know to me they're very much related." In recalling the following situation Ben reveals that being able to communicate ideas to people who have different experiences is a part of his makeup. In other words, he takes on teaching roles to communicate ideas to people with different backgrounds, which prepares him to be a bridge between perspectives:

"A friend of mine in marketing said hey, a key customer asked that we give them an explanation of our technology. They really would like to understand it better. And do you think you could come over and do it? Well nobody's ever done it before. You don't put engineers or technical people in front of customers! You know these things are just not done. I said yeah, that'd be great. I'd love to do that, actually. And so I put together this presentation and it was very simple. It was like you could have given it to second graders and they would have understood it. ... And they loved it. They thought it was great. And it went over so well that everyone's asking me do you think you could come and talk to

another major customer for us? ... And so it's partly technical but it's a lot of actually being a salesman and a teacher. I recognize that it's a very important of my makeup." [Ben]

The common feature of this quality of painting a picture is the ability to effectively articulate a vision and share it with others in a way that makes them see and care about the value of the proposition as a worthwhile goal. An example of effective articulation can be a prototype of the new idea with a story around it:

"Prototype or a product prototype is one of the quickest ways to get endorsement and to have your ideas at programs supported because it's something that is tangible and it brings together a lot of the thought process that an individual or a team had to a tangible thing. The most successful [prototypes] are usually – I'd say close to the down and dirty. The ones that you really want to build a program around, those need to be pretty, and a full story you put around them. So there is often a stage of progress that you would do with the prototype but you start with what I would call is down and dirty – quick mockup that conveys the essence of what you're thinking should be focused on." [Don]

"There just has to be a motivation that works for that bigger person ... To me, there is a great deal of satisfaction in getting other people to come around to a point of view that you believe in strongly, that they don't initially. And to get them to a point where it becomes a mainstream thought, and other people buy into it and it takes on a life of its own." [Ben]

Quality 4: Adaptability and flexibility

The quality of *adaptability and flexibility* illustrates the *ability of the big picture thinker to reposition oneself to adapt to new situations with openness, willingness and flexibility to venture into new situations*. This involves (1) **curiosity to learning** and trying new things; (2) **openness** to expand one's perspective; and (3) **willingness to venture** into uncertain situations. For Chris, this awareness can simply be taking a learner stance that recognizes the need to continually learn. He provides the example of a colleague he considers to be a big picture thinker: "She is very self-aware. She knows what she needs to get so she is receptive to that. She'll ask a lot of questions. Some people aren't self-aware of what they have and what they don't." He describes the learner stance of this awareness as the way "you process ideas and what things you need. You'll be effective if you kind of know how you work and being able to know how other people work."

Andrew notes that, "there tends to be more [of] this natural curiosity about bigger things." He provides the (contrary to him) example of a colleague who was not comfortable in a new situation:

"We had gone and collected some input from consumers. We had brought forward some technology stuff and got the marketing input as well. We worked with an outside innovation company to essentially come up with a way of

bringing these different perspectives together. And I remember one of my colleagues, like it happened yesterday. He said, I'm a scientist, I don't think like this." [Andrew]

In contrast, Andrew mentions why he chose to come to his company: "...I chose to come to [this company], probably because I thought it was, it was doing something very different than what I hear you know many of my classmates, going, at that time into kind of the big [...] industries. Uh, I felt like this was something very different..."

For the individuals in this study, being adaptable and flexible means being open to learning through others, appreciate what they do and pick it up:

"I think the biggest thing from a people perspective is you work closely with people and you pick up things and say, hey, I like the way that person does something. And then you say it's something I might want to consider ... So, you know, I guess there is a serendipity to it too." [Chris]

"There are several things that I think are important. One is being open and – and willing to share both experiences that are useful and, in some cases, show that you've got the weak side too – that you're human. Being open can also be challenging to the person that you're working with so seeing that you open and sharing helps. To encourage them to stretch themselves, but also be supportive to let them know that you believe they can do it and that it is not going to be terrible failure if it doesn't work out this time. It will work out in the future ... Expecting a lot, supporting and encouraging and then, you know, finally there's this piece about finding and identifying some teaching opportunities. In my experience most of the time, the capability's already there. The individual winds up teaching themselves. I can give facts, I can give examples. They do their own teaching." [Don]

Willingness to venture into uncertain situations requires flexibility to learning from mistakes. Ben mentions the importance of learning from mistakes, and laughing about them as well: "we still laugh about and say I don't think it will ever worse than that." He points to the experiences he had in the past that helped him learn how to adapt to new circumstances:

"The experience I had of being forced into this sort of fairly unstructured situations, even some of my early life [experiences], was also helping with that ... My experience has been when you have a group of people working together is that you figure out how to work together. I mean you might think you're gonna do a certain way beforehand but after you've been together for a year or two years, you sort of get good at working together. And you adapt to that and you adapt to the strength of the, of the individuals and, and so on." [Ben]

The ability to adapt to changing situations (for example, start working with a new team; switching roles; leaving original area of expertise) requires feeling comfortable with uncertainty, which sometimes needs taking an outsider perspective:

“We’ve tried to have the majority of the teams that are organized to carry this work forward – 60, 70 percent need to be at least comfortable, if not experienced, with that fuzziness. By the nature of what we’re trying to do, we need some individuals participating with us to keep us grounded as well as to take the message forward that are more black and white. Part of the challenge is to have enough detail and examples in our process information that the 30 percent of the group not familiar or comfortable with the fuzziness is okay, and doesn’t get too unsettled, and [so those] who are far enough along that they start to see the path forward.” [Don]

“You gotta be comfortable with that. And to what extent then others tend to follow that is partly related to what you see. But to me, that is another time of this notion of being an outsider; as being, once again, okay with seeing that connection or seeing what that opportunity could be even if no one else sees it.” [Andrew]

Quality 5: Opportunity formulation to make a difference

The quality of *opportunity formulation to make a difference* illustrates the *inner motivation to identify problems (over solving them) with an emphasis on making a difference*. This involves (1) **identifying problems and new opportunities** that holistically link perspectives rather than solving problems from a single perspective; (2) the desire to **make a difference** by engaging multiple perspectives; and (3) a collection of **values** that drive engagement in pursuing new directions. This quality is associated with attuning to the human dimension of a situation and the desire to have impact, whether for the organization as an entity or for society at large.

Don describes an experience associated with holistic approach to identifying an opportunity as a “journey of redefining how we were gonna position our products with what we call consumer target groups.” Don characterizes the “significant effort within the business and marketing organization to define that target consumer, understand the target consumer, and to build a target consumer profile”:

“[What Research and Engineering] needed to do was figure out how we translated that consumer profile into various aspects that Research and Engineering could develop delivery benefits for. So there was a translation need around this consumer profile—the behaviors and characteristics that this consumer set represented. And there were a number of these consumer profiles, depending on the brand and the position of that brand. So it was a challenge to figure out how to match science and technology development, research and development work, to deliver concrete benefits that would delight and please this consumer profile ... I consider it an example of big picture thinking because going in, you needed to

look holistically, or as much as possible – nothing is ever perfect – at where you were, what your endpoint was and how do you bridge that, and it’s a fairly significant gap between consumer and technology.” [Don]

Similarly for Chris, “starting at high level” and asking questions like, “What are we really trying to accomplish here? What’s important? What’s not important?” is needed to help the team “refocus” their efforts. He notes that this is a “legitimate concern” because otherwise the team will be “scattered and have a lot of different things going on.” Therefore, a crucial aspect of the big picture thinking is “understanding the overarching problem that you’re trying to solve, and then being able to draw from all quadrants on what could be an opportunity or a solution for that.”

Chris describes a decision at one point in his career as switching his role from the technical side of the company to the management side as being driven by a desire to make an impact:

“The only two things that are important are the people that sell the product and the people that make it. Everything else ought to contribute to those two things ... And, interestingly, the reason why I got into management in the first place was I was always more motivated by just delivering results, having an impact. And, at that time, I felt more the ability to do that on the management side because at that time, we were more oriented towards the management track, you’d be more accountable for deciding what it is we were going to work on, and I wanted to do that rather than get assignments. So I didn’t get into management because I really wanted the people side. I mean I like the people aspect, but that’s not why I did it. I did it because I felt like I could have more impact. And then now with this new opportunity to move over into this senior technical role, I feel like I can have more impact in this way.” [Chris]

Andrew notes that his desire to understand the details of processes in the organization was motivated by “this notion that it was somehow a consumer product company and that there’s all these emotional connections to people.” Initially, however, he points that “this was very much something very far from my decision making about coming [here].” Andrew makes the distinction of experiences he had between bringing technology forward, on the one hand, and coming from the angle of the customer, on the other. He describes one experience he had in his career where he had the opportunity to interact first hand with the customers; something that was not part of his prior experience as a technical expert:

“[I was] able to spend a couple days talking with people about their stories, about their dreams, about their frustrations, about the loss of their spouses in assisted living centers. [It] was really a real turning point for me to be able to spend a couple days hearing our consumers talk in their own language about what is it that they wish was, had been different in their life. To listen to people talk about this element of, you know, ‘do I want to keep living?’, ‘My husband is passed away’,

and ‘my body is shutting down and how can the rest of my life be meaningful and productive.’ I’d say that was very impactful on me in terms of this notion of recognizing the importance of people within corporate research engineering, to have a much better appreciation of our consumers. And I think that is something I have really been pushing in my role now as essentially the senior technical person within corporate research and engineering. I have been very much pushing this notion of, that we are not just here to bring technology forward, yes, that’s a primary expectation of a corporate research group, but we need to have a much better pulse on our consumers.” [Andrew]

A collection of values drive the engagement in pursuing new directions. Ben explains his early passion for what he does now and the satisfaction he gets as a reward for making a difference when the team works on something important: “It was just like this incredibly rich experience ... feeling like you’re almost part of a family and you’re doing something important.” The value for which Ben wishes to be recognized is not for day-to-day contributions, but rather the larger impact he makes on the organization:

“So there was a case of sort of selling the idea based on an understanding of what the consequences would be either way. And so I look at it in terms of okay, my activity in the [organization], my value in the [organization] was not what I did minute by minute, hour by hour, day by day. I could probably summarize it in terms of major contributions. I mean so okay, I was there for four years I don’t look at it in terms I was busy 12 hours a day; I look at it in terms of because I was there this happened that wouldn’t have without me being there. And so that was kind of the way I look at it whereas I think many, many other people are happy that they’re into the project, they’re executing it, they’re going through the steps that they need to go through. They’re not stepping back to look at it.” [Ben]

However, there is no agreement on what the “values to have an impact” actually are; for Ben it is the notion of overcoming a challenge, whereas for Andrew it is about giving something useful back to the society:

“I think it’s just wanting to win – you’re competing against somebody, and you want to have the satisfaction of winning in that competition. I think certainly for me that’s relevant ... I mean to me, there is an element where, ultimately, [if] what you’re doing doesn’t translate to business success, at some point, you feel like why is this useful? So I do think there is some element of I want to feel that I’ve contributed to the success of the overall business, and we are more successful than we would have been without my contribution.” [Ben]

“It’s much more about that sense of feeling like you’re doing something of some kind of benefit to society or the people that you tend to work with on a daily basis. And particularly being in a corporate research group, that notion of winning is a little relevant to me ... I think it’s more about giving. For our particular kind of product, it’s really about helping different segments of consumers be able to live their life in a way that’s meaningful.” [Andrew]

“I guess the point is I believe big picture thinkers want to have some sort of [impact]. I don’t think they care if they get credit, but they want see the impact.”
[Chris]

Concluding remarks

The idea of developing big picture thinking (in an individual as well as in an organization) is a networked idea. From the quotes provided, it is clear the qualities identified here for big picture thinker are interconnected. For example, a big picture thinker who challenges the status quo does that because of a connection that others are not seeing. In so doing, the BPT also thrives to paint the picture to others to make them see the connections. Simultaneously, the BPT adapts flexibly to the new direction being advocated. All this is driven by deep values that the BPT carries in order to have a significant impact and to make a difference.

The insights and findings presented in this paper will be used to develop a survey instrument to help identify individuals in the organization who show early indicators of big picture thinking as well as help promoting their development. We are conducting literature research for each one of the themes identified here to understand how they have been addressed in previous studies. Along with the empirical findings of this paper, the literature research will facilitate developing survey questions that can help identify early indicators of big picture thinking in individuals. The survey will include demographic questions as well as questions that target the specific five themes of big picture thinking. We are planning to distribute the survey to groups within the same organization that the BPT interviewed in this paper are members of it. The first group is a small group of individuals whom the BPT have identified as either (1) expert BPT, or (2) promising or on the edge of being a BPT. The second group will include participants from the different sectors of the company, where the survey will be administered within the larger group of employees within the company to explore broader trends and patterns within particular sectors of the company. This inclusion of experts and non-experts in this larger group will allow us to answer our research questions, presented earlier in the paper. The overall contribution of this research project to engineering education is a means for facilitating links between research and practice. This enables an easier interaction between what we know about “holistic learning” and how we teach and assess this kind of knowing.

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