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RESEARCH PAPER

The Power of Ethics: Uncovering Technology Risks and Positive Value Potentials in IT Innovation Planning

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Abstract The digital transformation of the economy is accelerating companies' engagement in information technology (IT) innovation. To anticipate which technologies will become relevant over time and integrate them in their innovation plans, companies often rely on product roadmaps as strategic tools. However, ethical issues resulting from ubiquitous IT use have shown the need to accommodate hyped technical advancements in information systems (IS) design and acknowledge human values with moral relevance. Scholars have argued that this moral relevance can only come from an ethical framework. The empirical study presented here investigates whether the three ethical theories of utilitarianism, virtue ethics, and deontology can complement traditional innovation planning approaches. The mixed-method study covers three IT products – a digital toy, a food-delivery app and a telemedicine system. The results reveal that the three ethical theories boost creativity around values and enrich IT innovation planning by supporting the acknowledgment of more and higher value principles (e.g., freedom or personal growth), more diverse value classes (e.g., individual and social values) as well as more original values (e.g., human contact) in system design. What is more, participants identify and mitigate potential social and ethical issues associated with the IT product. Against this background, the findings in this paper suggest that a "value-based roadmapping" approach could be a vital stimulus for future IT innovation planning.

Keywords Ethics · Values · Creativity · Technology · Design · Mixed-method study

1 Introduction

The digital transformation of the economy, fuelled by the rising performance of information technology (IT), is accelerating companies' engagement in IT product and service innovation planning (Shi and Herniman 2023; Spiekermann 2016b). Incumbents are pressured to defend a competitive position in an environment of start-ups that want to digitally disrupt existing markets. Young companies seek to develop convincing value propositions for investors and customers. The importance of creativity is evident in this environment of constant innovation and change (Dean et al. 2006). At the same time, more and more adverse effects of technologies are being reported on the individual, social, and societal level (Gimpel and Schmied 2019), which brings social and ethical implications into focus. Against this background, creativity in terms of more and new product features is not enough and leading innovation scholars have called for corporate innovation to show how it accommodates *values* (Martin et al. 2019; Nonaka and Takeuchi 2011; Porter and Kramer 2011). Values are "things that people find valuable that are both ideal and general, like justice and generosity" (Brey 2010, p. 46). A current challenge is to develop effective IT innovation planning approaches that help to identify relevant human values for information systems (IS) design and ethically assess problematic value breaches *before* an IT product is built.

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Many services have been subject to public criticism and legal backlash because important values have been undermined. Examples are privacy breaches (Verizon 2017), the development of mental health problems (Alonzo et al. 2021) or the loss of control to autonomous AI systems (Jobin et al. 2019). Yet, there are services that try to take values into account. Consider "fairness" in coffee production and the textile industry or "autonomy" in services such as the federated social network "Fediverse". In order to guide the design of such products and services, value-oriented approaches such as Value Sensitive Design (VSD; Friedman and Hendry 2019) have been developed. Typically, such approaches propose methods that help to identify relevant values for a specific IT context and to adapt the product or service under investigation so that it fosters positive values and avoids negative values. However, these methods have been criticized for lacking an ethical framework (Jacobs and Huldtgren 2021). In contrast, Value-based Engineering (VBE; Spiekermann 2023; Spiekermann et al. 2022), which had informed the development of the ISO/IEC/IEEE 24748-7000 "standard model process for addressing ethical concerns during system design" (International Organization for Standardization [ISO] 2022), proposes the identification of values from the perspectives of three ethical theories, i.e., utilitarianism, virtue ethics, and deontology. We have recently shown that the joint application of different ethical theories presents a fruitful way to establish an ethical basis for the identification of values in a practical setting (Bednar and Spiekermann 2022). However, to our knowledge, no empirical studies in IS have yet investigated to what extent such an ethics-based approach can drive ethical sensitivity *and* IT innovation creativity when compared to more traditional forms of innovation planning, such as product roadmapping.

Product roadmapping is an established innovation practice pursued by companies to this day (de Alcantara and Martens 2019). Current roadmapping techniques have been extended to deal with uncertainty in technology innovation (Lee et al. 2021) and to manage agile processes (O'Sullivan et al. 2021). Generally, product roadmaps help innovation teams to translate economic and technical values into product characteristics, following the idea that technical features and efficiency satisfy customer expectations. In contrast, the ethical innovation planning approach we propose here identifies values from the moral context of the IT product and translates them into concrete design ideas. In this article, we argue that "technology-based" roadmapping has the potential to transition into "value-based" roadmapping when including important aspects of value-oriented approaches. First, the empirical and conceptual investigation of values (Friedman et al. 2013; International Organization for Standardization [ISO] 2022) before the definition of a roadmap or the development of first prototypes allows the consideration of a wide variety of human and social values that can drive disruptive innovations (Spiekermann 2023). Second, the concept of values can be morally framed and goes beyond the consideration of needs. This is vital, as all needs can be represented as values, but not all values can be captured by needs. What is more, value-oriented approaches embrace indirect stakeholder groups (Friedman et al. 2013; Spiekermann 2016a), such as communities or society at large. Finally, value-oriented approaches put a critical emphasis on potential negative consequences of IT products, which they envision in the long term and at scale (e.g., with the use of *envisioning cards*, Friedman et al. 2017).

In the past, it was sometimes argued that a concern for values such as privacy would undermine the innovativeness of an economy (e.g., Holden 2020). Thus, an ethical approach to IT innovation planning should not only be sensitive to potential harms and adverse effects that information technologies can have (as listed, e.g., by Gimpel and Schmied 2019), but also propose creative ways to foster positive value potentials of a technology for human welfare. Wallach and Vallor (2020) define creative moral reasoning as "the ability to invent new and appropriate moral solutions in ways underdetermined by the past" (p. 392). It is evident that any departure from known ethical issues involves some degree of speculation. Yet, the ethical "forecasting" involved in identifying values allows to unveil various potential ethical issues that a technology could bring about (Brey 2012), increasing creative thinking alongside ethical sensitivity. To account for the importance of creativity in the design and innovation context, we compare to what extent the two approaches lead to different value ideas. Additionally, we want to explore specific nuances that result from each ethical perspective (utilitarianism, virtue ethics and deontology). In particular, we focus on their capability to identify higher intrinsic values that a technology can support. Furthermore, value ideas generated by product roadmapping and the ethics-based approach are compared in terms of the number of new ideas (fluency) and their originality, which both represent traditional parameters in the evaluation of idea generation (Batey 2012; Dean et al. 2006). In addition, we also investigate how many different value dimensions the generated ideas cover, which reflects the flexibility of participants' creative thinking. All three parameters originate from Guilford (1966, 1971), who conceptualized creativity as a person's ability to generate many new solutions to a problem.

Our paper is structured as follows: we first show how the consideration of human values has recently become more important in IS design and introduce the moral philosophies of utilitarianism, virtue ethics, and deontology for

establishing an ethical framework. Then, we discuss traditional product roadmapping and derive research questions on innovation planning ideas resulting from product roadmapping and an ethical product planning approach. Next, we present our mixed-method study, which combines a qualitative analysis of the resulting ideas with a quantitative comparison of the two approaches. Based on a bike courier application, a smart teddy bear, and a telemedicine system, our results show that the participants' creativity dramatically increased when they were engaged in ethically grounded thinking. In that case, the participants came up with more than three times as many value ideas, but were also more flexible and original in their thinking about values. Moreover, the ethics-based approach helped to anticipate potential negative implications for a broader range of affected stakeholders, contributing to better ethical foresight. We conclude with a critical discussion of our empirical findings as well as implications for IS theory and practice.

2 Values and Technology

Before we present our research questions, we provide a short overview of the value construct and the three moral philosophies that form the ethical framework, as they are not yet widely used in IS research. From a broader philosophical perspective, values can be defined as "conceptions … of the desirable" which influence human choices (Kluckhohn 1962, p. 395). However, philosophers have outlined that values can also be negative (Hartmann 1932; Scheler 1913–1916/1973). A classic example for a positive value is beauty, a value that, for instance, drove the success story of Apple and that is qualitatively distinct from the negative value of ugliness. Values can also be differentiated in terms of "extrinsic" or instrumental values, which present "a means to achieving a good end, i.e., another positive value" (van de Poel 2009, p. 976), and higher "intrinsic" values that are experienced as deeper, more durable and fulfilling, and do not depend on other values (Scheler 1913–1916/1973). Furthermore, it has been argued that the consideration of values can support *sustainable* IT innovation planning. This way, the classical focus of sustainability is extended beyond the protection of the natural environment to also include human beings and social groups as equally important resources to protect and foster (Penzenstadler and Femmer 2013; Winkler and Spiekermann 2019). For example, scholars are now calling for "sustainable pathways" and high ethical value principles to be respected in AI design and development (Mittelstadt 2019; van Wynsberghe 2021).

The past twenty years have seen a number of value exploration and design methods for IT design and innovation. These include: *values in technical design* (Nissenbaum 2005), *values at play* (Flanagan et al. 2005), *worth-focused design* (Cockton 2020), *value sensitive design* (VSD; Friedman and Hendry 2019), and *value-based engineering* (VBE; Spiekermann 2023; Spiekermann et al. 2022) with the related ISO/IEC/IEEE 24748–7000 Standard (International Organization for Standardization [ISO] 2022). Among these approaches, VSD is the most prominent. It already emerged in the 1990s and can look back on more than two decades of research (Winkler and Spiekermann 2021). VSD has accumulated many qualitative learnings on the dynamics of individual values and their role in various case studies (e.g., Friedman et al. 2006; Helbing et al. 2021; van Wynsberghe 2013), along with a set of methods for stakeholder identification, value elicitation, and values analysis (see Friedman et al. 2017 for an overview). However, the claim that values uncovered in VSD approaches support *ethical* design has been criticized as they are not systematically grounded in moral philosophy and need a higher commitment to ethics (Jacobs and Huldtgren 2021; Manders-Huits 2011; Reijers and Gordijn 2019).

This criticism is significant, as the moral foundation of values is the core feature that distinguishes values from concepts used by other design and innovation approaches (Fuchs 2020). For example, design thinking analyses human *needs* in an early ideation phase before prototypes are built, but does not focus on the many values cherished by people beyond what they need. Nor does it seek to unveil ethical issues of IT innovations while planning for them. At the same time, values can only help to translate ethical requirements if they "distinguish that which should be, as opposed to that which is" (Shilton 2018, p. 128). Without an ethical framing, values identified in a technology context merely represent individual preferences (Reijers and Gordijn 2019) instead of non-instrumental values that are "intrinsic" or "higher" in an ethical sense.

3 Moral Philosophy in IT Innovation Planning

The question arises how ethical framing can be provided. A discussion of the moral reasoning underlying VSD can be found in one of the earlier papers (Friedman and Kahn 2003), where utilitarianism, deontology and virtue ethics are assessed as overarching moral theories. Deontology and utilitarianism have already been studied as underlying ethical theories for general ethical decision-making outside of the IT innovation context, while virtue ethics has only rarely been included (Drašček et al. 2020). At the same time, virtue ethics has been suggested to be especially well suited for framing ethically grounded practices in

information technology design and development (Consoli 2008; Reijers and Gordijn 2019), e.g., in van Wynsberghe's (2013) project on care ethics in robotic health care assistants. Others have proposed a pragmatist approach to value identification in innovation practices (Boenink and Kudina 2020) as well as the use of "mid-level" ethical theories for VSD (Jacobs and Huldtgren 2021). These sources provide first theoretical arguments and empirical insights on selected ethical frameworks that could be used in IT innovation planning. However, every ethical theory is based on a unique ethical reasoning, and it is evident that the use of different theories leads to the identification of different sets of values. So how is one supposed to decide which theory to choose?

VSD scholars stress that *any* ethical theory can be used for the value elicitation in IT innovation planning projects (Friedman and Hendry 2019). And yet, we have recently shown that ethical theories should be jointly applied in a practical setting (Bednar and Spiekermann 2022), as practiced in VBE and ISO/IEC/IEEE 24748-7000 (International Organization for Standardization [ISO] 2022). Based on the perspectives of utilitarianism, virtue ethics, and deontology, innovation teams that employ VBE (1) list the potential stakeholder harms and benefits of an envisioned technology once a system-of-interest is used at scale (utilitarian perspective), (2) think about long-term character effects resulting for direct and indirect human stakeholders when using it (virtue ethical perspective), and (3) reflect on personal maxims that they consider of universal importance to foster or protect in the light of such a technology (deontological perspective). In the following, we briefly review the ethical reasoning underlying each of these three ethical theories.

Utilitarianism is a form of consequentialism and seeks to maximize the general good for the greatest number of people (Frankena 1973). The utilitarian principle with its emphasis on possible consequences can still be found in basic concepts of neoclassical economics and business which demand the maximization of positive outcome by choosing the action that is estimated to result in the highest positive value. The utilitarians Jeremy Bentham (1748–1832) and John Stuart Mill (1806–1873) interpreted this highest positive value in psychological terms as pleasure, social utility, or wellbeing (Mill 1879/2009; Bentham, 1789/1907). With this, they provided a strong and simple reasoning for the evaluation of what is morally right. Utilitarianism has since been heavily criticised in the philosophical community for failing to see human virtues (MacIntyre 2007), for taking "a view from nowhere" (Nagel 1989) and for justifying harms with benefits (Frankena 1973). Thus, it is problematic when ethical technology assessments are mainly based on utilitarian reasoning (Grunwald 2017).

A worthy complement to Utilitarianism is *virtue ethics*, which is one of the oldest and most prominent ethical theories. It specifically emphasizes the moral excellence of a person's character rather than her adherence to rules of action, duties, or resulting consequences. Virtues represent "a disposition, habit, quality, or trait of the person or soul, which an individual either has or seeks to have" (Frankena 1973, p. 64) and together form a balance within the social context of an individual (van Staveren 2007). According to classical virtue ethics, only a truly virtuous person will live in true happiness (*eudaimonia;* Aristotle 2004). While virtue ethics played a subordinate role in Western philosophy in the last two centuries, it has recently shown great potential as a means to deal with ethical issues posed by new technological developments (Vallor 2016). In fact, many debates about the drawbacks of IT systems are now centring on how technology degrades humanity (Orlowski 2021), inflates personalities (Elias 2012), and shows adverse effects both at the interpersonal level (e.g., cyberbullying) and in our society at large (e.g., hate speech in social media; Gimpel and Schmied 2019). Therefore, VBE with ISO/IEC/IEEE 24 748–7000 specifically assesses negative character effects of IT systems.

Deontology emphasizes that consequences do not determine what is morally good and right, and that we are obliged to follow moral principles that have a universal character. "Deon", the Greek word for duty, implies that we are obliged to follow such moral principles. Immanuel Kant (1785/2011) captured this in his categorical imperative "act only according to that maxim by which you can at the same time will that it should become a universal law" (p. 71) and added that the *outcome* of an action can never justify the action itself (Kant, 1785/2011). Duties in the form of moral rules have a long tradition in many societies, and even form a common instrument of moral guidance in the corporate context, e.g., in the form of professional codes of ethics such as the one adopted by the ACM (Association for Computing Machinery 2018). The ethical and policy-oriented evaluation of technologies such as autonomous cars has also been influenced by universal principles, such as the equality of people, which does not allow for discriminating against humans based on their individually distinct characteristics (Ethik-Kommission 2017).

4 Technology-Oriented Versus Value-Oriented IT Design

A company that tries to extend their products and services with the help of IT typically develops a product roadmap to plan what it wants to design and develop over time. Product roadmaps are strategic innovation tools that help companies with their long-term planning and foresight

activities (Kerr and Phaal 2020) based on the market (customer needs and competition) and anticipated technical novelties. The product (or technology) roadmapping approach is deeply rooted in industry practice (Kerr and Phaal 2020) and embedded in major student textbooks on IT innovation planning and management (Ahmed and Shepherd 2012). To this day, organizations widely apply product roadmapping (de Alcantara and Martens 2019). The Annual Product Management and Marketing Survey (Pragmatic Institute 2021) presents "maintaining the roadmap" as the most frequently listed activity of product managers (89 percent) in 2020/2021, with an average of 12 h per month spent on planning and communicating the roadmap.

At the core of a product roadmap is a constantly updated technical dashboard that summarizes the product's characteristics, functions and features that go into an existing product or service over time. With the help of technology and industry forecasting, companies analyse which technological capabilities might become relevant over time and anticipate how competitors might try to take advantage of these (Ahmed and Shepherd 2012). Based on this analysis and their own technical maturity, they decide to invest in certain technologies that then determine the product and service characteristics in their roadmap. This feature-driven approach has been criticized for not accommodating current requirements such as a better consideration of the customers' needs and behaviours and a higher flexibility in volatile environments (Münch et al. 2018). In recent years, human, social and environmental values have gained importance in judging innovations: investors are more sensitive to the many harms and uncertainties that an innovation may create, affecting values such as privacy, security, or transparency (Jobin et al. 2019). Against this background, companies are pressured to anticipate potentially adverse effects that an IT innovation might entail (Gimpel and Schmied 2019).

Negative value potentials inherent in a new IT product can only be addressed in the design of the system proactively if an innovation planning process is sensitive to such risks. From a product roadmapping perspective, companies build innovations for their customers (Albright and Kappel 2003). Thus, when a negative impact on important values such as privacy or security becomes the subject of public discourse or is addressed by customers, a company's consideration of these issues might find its way into the roadmap. Still, value issues beyond those discussed in the media are unlikely to be recognized by a traditional product roadmap. In contrast to roadmapping, value-oriented approaches start from the identification of harms and benefits that could arise for stakeholders, and VBE explicitly anticipates both positive and negative value potentials inherent in a new technology or technological innovation. From this, we derive our first research question regarding the sensitivity for potential adverse effects.

Research question 1 (adverse effects): *Does an ethical product planning approach based on utilitarianism, virtue ethics, and deontology lead to the identification of more potentially adverse effects of the envisioned IT product than product roadmapping?*

We acknowledge that we could also compare the creative and ethical potential of value-based roadmapping to approaches that have been developed more recently. We take product roadmapping as our comparative baseline in this study for three reasons. First, IT innovation planning is still strongly driven by technology hypes which influence expectations in innovation evolution (Shi and Herniman 2023). Second, in many companies, daily innovation planning practices centre on technical product roadmaps that are also used to manage agile processes (de Alcantara and Martens 2019; Munch et al. 2019; O'Sullivan et al. 2021) and remain the primary focus of teams involved in IT innovation planning. Third, product roadmapping has been studied extensively and has been extended to deal with current challenges (de Alcantara and Martens 2019; Munch et al. 2019; O'Sullivan et al. 2021), whereas research efforts on novel approaches such as design thinking have been outpaced by practice and training (Puccio and Cabra 2012). In this article, we focus on the possible contributions of a value-based approach to traditional product planning approaches. However, the morally framed concept of values that we embrace is also relevant for other well-established design approaches, e.g., design thinking and VSD methods (Friedman and Hendry 2019).

5 Innovation, Creativity, and Values

From an IS perspective, *innovative* products result from *creative* processes aimed at solving particular organizational problems (Hevner et al. 2004). This shows that innovation and creativity are deeply interrelated concepts. In line with this, product innovation explicitly deals with the "creation and introduction of new (technologically new or significantly improved) products which are different from existing products" (Edison et al. 2013, p. 1394). At the same time, creativity is also defined by various aspects that set it apart from innovation, including usefulness and appropriateness (e.g., Erez and Nouri 2010), whereas innovation includes the *implementation* of new ideas for a new product or service (Martins and Terblanche 2003). And still, it is not surprising that the two terms are sometimes used synonymously (Martins and Terblanche 2003). At the core of both innovation and creativity lies the creation of something "new" (Amabile 1997; Batey 2012; Erez and Nouri 2010; Han et al. 2019; Runco and Jaeger 2012).

The "newness" aspect has been defined in various ways. In classic innovation literature, Rogers and Shoemaker (1971) defined "new" as whatever is perceived as new, including new knowledge or a new attitude: "An *innovation* is an idea, practice, or object perceived as new by an individual. If the idea seems new to the individual, it is an innovation" (p. 19). Hauschildt and Salomo (2011), on the other hand, emphasized that "new" cannot just refer to a gradual change or improvement of a technical problem; rather, innovations refer to "qualitatively new products or processes that "noticeably" distinguish themselves – however this is to be determined – from a comparable situation" (p. 4, translation by authors). In creativity theories, novelty is usually understood as "originality" and constitutes creativity (Batey 2012; Dean et al. 2006; Runco and Jaeger 2012): "if something is not unusual, novel, or unique, it is commonplace, mundane, or conventional; it is not original, and therefore not creative" (Runco and Jaeger 2012, p. 92). There are various ways to operationalize creativity based on a variety of theories, models and levels (Batey 2012; Wang and Nickerson 2017). According to the 4Ps theory of creativity (Rhodes 1961), creativity can be understood in terms of the creative process, the creative person (or trait), the creative product, and the creative environment (or press). Amabile (1982) argued that "a product-centered operational definition is clearly most useful for empirical research in creativity" as "any identification of a thought process as creative must finally depend on the fruit of that process – a product or response", and the same goes for the identification of a creative person (p. 1001). This argument is based on the view that processes occur within a person to produce a product; which has led to the dominance of the product-oriented definition of creativity (Batey 2012).

To account for the importance of creativity in the design and innovation context, we assess value ideas in terms of three creativity parameters, i.e., fluency, flexibility, and originality. These parameters originate from Guilford (1966, 1971), who conceptualized creativity as a person's divergent-production ability, that is, the ability to generate many new solutions to a problem. Typically, this is tested as the ability to come up with multiple responses to an open task, or in the present context, the number of ideas generated in the course of product ideation. We use this account of creativity as the generation of new ideas as it is especially well suited to evaluate creativity with a focus on ideas that relate to values. Generally, there are good arguments for considering other aspects than quantity when evaluating generated ideas, and quality, novelty, and creativity are among the most commonly used constructs (Dean et al. 2006). However, we focus on *value ideas*, that is, ideas that relate to or represent a value, and every such value idea is potentially relevant for the subsequent steps of the innovation process. This is because our proposed ethical framework for the value identification phase justifies an understanding of values as representing what people appreciate as good and right in the form of principles and ideas. Thus, the number of value ideas in terms of fluency represents a relevant and objective first indicator for value creativity. Guilford's other two creativity aspects of provide additional parameters for the quality of the value ideas, whereby the flexibility of value ideas is understood in terms of covered value dimensions and originality in terms of rare ideas.

In this paper, we look into likely benefits in terms of creative value output that companies might enjoy when embracing an ethics-based approach rather than a traditional roadmapping approach. The following research questions focus on value ideas, i.e., product design ideas that participants connect to a value or virtue or where such a connection is implied. For example, an app that allows users to select font sizes fosters "accessibility", and a feature to enable conference calls could foster "friendship" or increase "efficiency". Guilford (1971) referred to the number of ideas generated in the course of product ideation as ideational *fluency*, meaning the ability to come up with multiple responses to an open task. In our context, fluency translates to the number of ideas that participants come up with in the product roadmapping and ethical value-based product planning tasks. In product roadmapping, the focus lies on new features which drive technology strategy and competitive advantage (Albright and Kappel 2003; Cooper and Edgett 2010; Pham et al. 2013). Thus, a product roadmap makes participants consider product design ideas that are linked to presumed customer values, anticipated economic values, and values created by the technical capability of the envisioned product. In the ethical product planning, on the contrary, values are discovered by taking the three ethical perspectives of utilitarianism, virtue ethics, and deontology. These different theoretical angles regarding what "ought-to-be" can produce a variety of ideas on how human values are impacted by a certain technology. At the same time, taking an ethical perspective might also impede a person's creativity and restrict the resulting number of ideas. Research question 2 addresses how adopting multiple ethical lenses plays out in terms of the participants' ideational fluency of value ideas.

Research question 2 (fluency): *Does an ethical product planning approach based on utilitarianism, virtue ethics, and deontology inspire more value ideas than product roadmapping does?*

In line with Guilford's (1971) conceptualization of creativity as divergent thinking, we explore not only ideational fluency, but also the flexibility of thought and the originality of ideas. *Flexibility* refers to the production of ideas that transcend thinking in fixed categories or

classes (Guilford 1966). Many scholars still associate the term "value(s)" with monetary benefits as opposed to costs, or as an organization's unique "value proposition" in terms of business strategy (Pham et al. 2013). Even versions of traditional product roadmapping that are referred to as "value roadmapping" (Dissel et al. 2006) in the end only focus on value in terms of "revenues" and "savings" and ignore human, social, or moral aspects. A broader understanding of values sees value harms when, for instance, a plane is not safe, a car engine not environmentally friendly or a social network manipulative. Such threats depart from the reduced understanding of risks as *competitive threats*, which product roadmaps can build upon (Kappel 2001). Recent work (Winkler and Spiekermann 2019) has linked IT-related values to the principle of sustainability (Penzenstadler and Femmer 2013), which comprises *technical*, *economic*, *social*, *individual* and *environmental* sustainability as dimensions. The question we investigate below is whether an ethical focus, as opposed to roadmapping, helps participants to account for values that take several sustainability dimensions into account or whether it restricts their thinking to specific value classes.

Research question 3 (flexibility): *Do value ideas inspired by an ethical product planning approach based on utilitarianism, virtue ethics, and deontology cover more value classes than value ideas generated in product roadmapping?*

Regardless of the method, it is likely that many participants will address "mainstream values" (Spiekermann 2016a), that is, values that often come up in public (technology) discourses or are part of ethical guidelines. A good example for a mainstream value is privacy, as it relates to a wide area of research of recent years (Yun et al. 2019) and is often listed as an ethical principle that should be acknowledged in IT development (Jobin et al. 2019). In contrast to such mainstream ideas, *original* ideas are ideas that are rare among a set of possible solutions (Thys et al. 2014) and represent a core aspect of creativity (Batey 2012; Dean et al. 2006; Runco and Jaeger 2012). They signal a person's thinking outside the box and existing frames of reference. They target values that go beyond easily accessible concepts and focusing on the unique specificity of, e.g., a technology context. Therefore, our last research question investigates the originality of value ideas inspired by both the ethics-based approach and the product roadmap.

Research question 4 (originality): *Are value ideas inspired by an ethical product planning approach based on utilitarianism, virtue ethics, and deontology more original than value ideas generated in product roadmapping?*

Considering that values are highly context-specific, we chose three IT products to explore the research questions outlined above. It is difficult to estimate the effect of a particular form factor or context of use on the innovation process, which is why we explore this question empirically.

6 Methodology

Figure 1 provides an overview of the procedure that we describe in more detail in the following sections, including the procedure, the sample, the three technology cases as well as the qualitative and quantitative analyses.

The within-subjects design we used allowed us to test whether the same participant could come up with *new* ideas when following instructions based on different ethical perspectives. In order to mitigate a potential order effect, we strictly controlled for all idea overlaps, that is, we only included a participant's idea if it had not been mentioned in a previous analysis. For example, when a participant mentioned "privacy" in the product roadmap and again in the utilitarian analysis, it was only counted for the product roadmap. Similarly, when a participant noted down an idea related to the value "health" in the utilitarian analysis and mentioned "health" again in the deontological analysis, we only counted it the first time.

6.1 Procedure

Over the course of two semesters, a total of 71 IS university students engaged in two IT innovation planning tasks: product roadmapping and an ethical product planning task based on utilitarianism, virtue ethics, and deontology. In both semesters, the participants received roughly 6 h of introductory lectures on innovation planning and management, including the product roadmapping technique. They were then asked to develop a product roadmap for the respective IT product and identify product ideas by reflecting on technological developments, market competition, and presumed user needs. After completing this first innovation planning task, the same students received a 6-h introduction to the three ethical theories of utilitarianism, virtue ethics, and deontology. They learned about the core ethical reasoning of these theories and how they can be used as a framework for eliciting values (Spiekermann 2016a). The participants were instructed to employ the perspectives of utilitarianism, virtue ethics, and deontology subsequently. They noted down (1) potential benefits and harms that arise for stakeholders (utilitarianism), (2) impacted stakeholder virtues (or vices; virtue ethics), and finally, (3) personal maxims that could be undermined or should be fostered by the innovation (deontology). This order was the result of two small pilot studies conducted beforehand that showed that utilitarianism triggers the highest number of ideas and thus offers a good starting point, while deontology provides the most critical

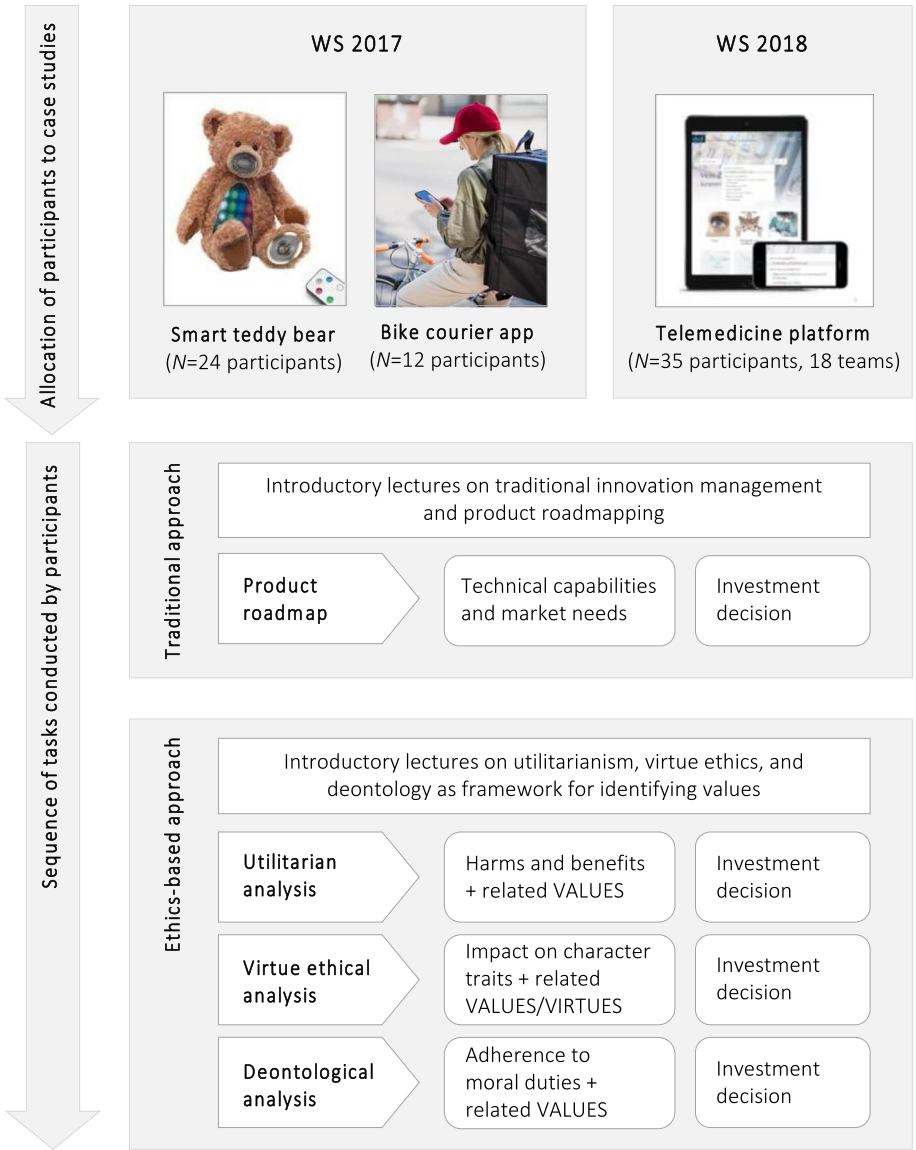

Fig. 1 Procedure including preparation, allocation to case studies, and tasks

perspective and thus qualifies best as the last ethical analysis. Participants labelled all benefits, harms, virtues and maxims individually to capture the underlying value. Afterwards, they derived product characteristics to address how the respective value can be considered in the technology's design. Only participants who completed all analyses of the respective IT product were included. The participants received credit points for these tasks and later took an exam on the two innovation planning tasks.

The participants worked on one of three technology cases. In the first semester, 36 students were split into two groups which worked either on the fictitious product scenario of a smart teddy bear dedicated to the entertainment of children or on a bike courier app that organizes the tasks, contracts, and payments of bike couriers who deliver restaurant food from to private consumers. To explore yet another technology, we repeated the procedure one year later, where another group of 35 students worked on the real-world case of a telemedicine system which links patients to recommended medical experts. Table A1 in the appendix (available online via http://link.springer.com) shows the data collection and analysis process with instructions for each ethical analysis, as well as the aggregated factors we derived from the qualitative data. In order to compare the patterns of results across the two semesters and the three technologies, we kept the study design as similar as possible in a non-laboratory context. Still, instructions in the second study iteration differed slightly, see Table A2 in the appendix.

Table 1 Overview of descriptive sample statistics

	Bike courier app	Smart teddy bear	Telemedicine system
Number of participants	12 individuals	24 individuals	35 individuals, 18 teams
Age	M = 23.0, SD = 1.5	M = 24.4, SD = 3.0;	M = 24.6, SD = 2.6
Gender	50% female	54.2% female	38% female
Nationality	9 different nationalities	16 different nationalities	14 different nationalities

6.2 Sample

The three samples of participants working on different technology cases showed a rather balanced distribution of gender and a diverse national background. Table 1 provides an overview of the descriptive statistics including age, gender, and nationality.

All student participants were enrolled in an IS master programme which requires 700 full hours (28 ECTS) of computer science training and at least 1500 h (60 ECTS) of business management and/or economics training prior to enrolment. Thus, the participants had a solid technological and economic background for an IT innovation planning task.

6.3 Case Studies

A bike courier app is a smartphone application that organizes the tasks, contracts, and payments of couriers who deliver food from restaurants to private consumers by bike. The case of the bike courier app was based on *Foodora*,[1] the market-leading company offering such a bike courier service at the time. We chose this technology case because it represented a new digital service that had been taken up quickly and with great enthusiasm by costumers and cooperating restaurants. A bike courier app supports B-2-C services (customers can order food and receive information on the delivery status when using the app) but can also be used by the company to manage transactions (e.g., monitor food deliveries or payroll) and employees (e.g., through digital contracts). Thus, it combines traditional economic values such as efficiency with individual values such as comfort. What is more, the delivery by bike implies an appreciation of the natural environment, while at the same time posing challenges for the courier's safety. Since 2017, the case of Foodora has become even more ethically relevant. The company was in the news because of its tough policies and low hourly wages (Chau 2018). This shows that the impact of a specific technology on affected stakeholders has high moral relevance, especially in a context of unequal power relationships. At the same time, the criticism that Foodora has been confronted with emphasizes the need to come up with a better design of the digital platform to organize the bike couriers' job assignments for services such as Foodora, Uber Eats, Mjam, etc.

The smart teddy bear is a fictitious toy that targets 2- to 9-year old children. The case of the smart teddy bear was based on *Fisher-Price*,[2] a well-known company producing various toys including educational toys that respond to a child's touch with songs and phrases, among other functionalities. We chose a smart toy as it represents a personal recreational consumer product specifically designed for children and families in their homes, and thus poses a highly morally sensitive context for the design of an IT product. Moreover, a smart toy can bring joy and fun and offer new ways of learning and exploration to the child. On the other hand, the technical equipment of smart toys including microphones and cameras may raise ethical concerns. Recent research has shown that privacy, security and ownership are typical examples for the ethical issues related to smart toys, especially those connected to computing services in a cloud (Chang et al. 2019).

The telemedicine system is a real-world business case that was presented live to the participants by the CEO of a start-up company. The platform operates by connecting patients to a general practitioner who first makes an online diagnosis and then refers patients to specialized doctors highly recommended by their peers. The telemedicine system should enable any patient to find the best suitable doctor for his or her medical problem, regardless of the patient's social network, and facilitate communication through the platform. While the obvious envisioned beneficial effects are related to values such as "health", "equality", and "efficiency", the underlying recommendation system and the telecommunication system also raise ethical issues. For example, ensuring the right reasoning for a recommendation among doctors who know each other and try to support each other might prove difficult. Also, the lack of physical interaction could impair the doctor's decision-making and diagnosis skills. What is more, the medical context is especially sensitive when it comes to potential privacy and security breaches. Thus, this technology case offered the opportunity to come up with design ideas that would protect the morally desirable features of the digital service while at the same time avoiding potential harms.

[1] https://www.foodora.com/.

[2] https://shop.mattel.com/pages/fisher-price.

6.4 Data Coding and Content Analysis

Innovative thinking is a highly creative exercise (Amabile 1997). We had expected to assign a list of values to value classes based on the collected data, but the resulting qualitative material was much more complex. To capture the meaning of the more than 2000 product innovation ideas we collected from the participants in the two studies, we applied a mixed-method approach in various data analysis cycles. Figure 2 presents a schematic overview of the coding process and the higher-level category groups and value classes that we identified.

In the first study iteration based on the bike courier app and the smart teddy bear, we developed a detailed category system from the participants' original idea descriptions. Participants entered their ideas for the respective IT product into a structured template which included tables to be filled in. Still, the participants used different styles to note down their ideas. This resulted in differently structured ideas, which were difficult to analyse and compare. One difficulty was the differing level of detail of the descriptions of the envisioned product impact (e.g., an undermined personal maxim). While some participants gave very elaborate answers, others provided very generic descriptions of their ideas. The related values that participants had to put next to each of their ideas were even more problematic. In some cases, the participants listed several different related values with one idea or linked a generic value with a very specific value description. To ensure comparability, we developed a category system on the basis of all participants' original idea descriptions and labels. The category system represented categories (= common labels) as well as the direction of the described technology effect that could be either positive, negative or neutral. For example, the digital teddy bear sharing data for unwanted reasons would be coded as a "negative" idea relating to "privacy". Two coders applied the category system independently using the ATLAS.ti software, yielding *good* intercoder agreement for a first sample of ideas ($k = 0.74$ for the smart teddy bear, $k = 0.78$ for the bike courier app; Cohen et al. 1960) and *substantial* agreement for the final coding of the complete dataset of the smart teddy bear ($k = 0.69$) and the bike courier app ($k = 0.65$). We resolved all disagreements in discussions with the respective coders until full agreement was reached. Then, two coders applied the category system to the participants' ideas for the telemedicine system with an initial agreement of 81.8%. The category system was iteratively refined until full intercoder agreement was reached, resulting in 272 final labels. Additionally, we assessed the number of stakeholders mentioned in the idea descriptions.

In a second qualitative analysis, we grouped all labelled ideas on a higher level of abstraction (Mayring 2014), filtering 187 values and virtues from other category groups that we recognized as *product characteristics* (e.g., "reward system", "health monitoring", or "entertainment programme"), a stakeholder's *characteristics/abilities* (e.g., increased "curiosity", "humour", or "social skills") and *emotions* (e.g., "feeling rejected" or "joy"). We derived these three category groups from the qualitative data and assigned every idea exclusively to one category. We categorized ideas as *values* if they represented a good that is valuable in itself (i.e., an intrinsic value such as "freedom" or "health") or a means to such a higher value (i.e., an instrumental value such as "accuracy" or "transparency"; Hartmann 1932; van de Poel 2009). We categorized ideas as

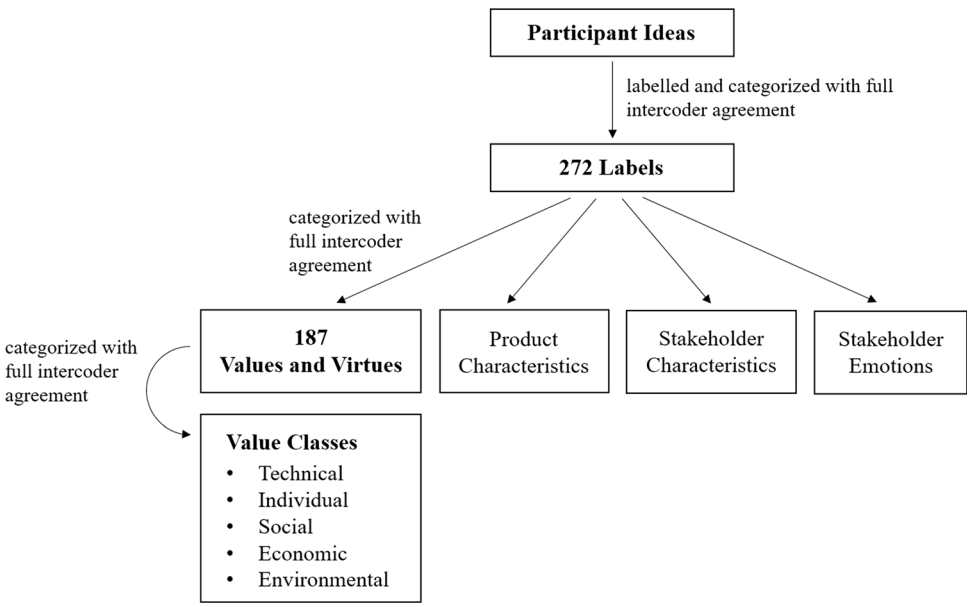

Fig. 2 Overview of coding process including developed category groups and value classes

virtues if they described long-term morally good character traits or dispositions that are socially desirable and appreciated (e.g., "considerateness" or "kindness; Frankena 1973). We understand virtues as *values inherent in the good character and conduct of a person*, and thus include them when we henceforth refer to "values" or "value ideas".

Finally, to qualitatively distinguish between different classes of values, we used the value classification by Winkler and Spiekermann (2019), which is based on dimensions of sustainability. These dimensions span social, technical, individual, economic, and environmental sustainability as well as combinations of these (e.g., techno-social sustainability). Two coders iteratively assigned every value or virtue to a value class (a sustainability dimension or overlapping sustainability dimensions) until they reached full agreement. In the coding process, the "overarching values" listed by Winkler and Spiekermann (2019) served as an orientation for the assignment to value classes. In some cases, the label we used for a value did not coincide with an overarching value, but with a "specific aspect" that Winkler and Spiekermann (2019) see associated with an overarching value. For example, the value category "fairness" that emerged in our data was mentioned as a specific aspect of the overarching value "justice" and related to social sustainability in the categorization of Winkler and Spiekermann (2019). Throughout this process, we established descriptions for each value class, see Table A3 in the appendix. We discussed disagreements and iteratively refined the definitions of the value classes until we reached full agreement.

The appendix includes the complete category system showing all 187 value categories with descriptions, arranged in intrinsic values (Table A4), instrumental values (Table A5), and virtues (Table A6).

6.5 Value Creativity Variables

We used Guilford's conceptualization (1971) to assess the creativity unleashed by the two innovation planning tasks in terms of value idea fluency, flexibility and originality. A classic fluency task asks to list, for example, consequences of a given event, or uses for common objects (Guilford 1971). To assess *value fluency* (Research question 2), we focused on the number of value ideas, i.e., ideas that either related to a value (e.g., accuracy, convenience, accessibility, etc.) or implied a value. For example, when a participant mentioned encryption for better security or a "secure system" in the product roadmap, we categorized this implicit value of security as a value idea. The fact that we controlled for idea overlaps to mitigate order effects (as described above) also warrants that fluency refers only to the number of *new* ideas that each participant came up with in the respective tasks. Research question 3 looks at how flexible people are in their creative thinking, which combines a qualitative with a quantitative assessment (Guilford 1966, 1971). We operationalized *value flexibility* as the number of value classes (i.e., sustainability dimensions) that a participant's ideas span. The third aspect, originality, is one of two characteristics that are most widely ascribed to creativity (Batey 2012). It has also been referred to as "rarity", that is, the "infrequency of an idea, measures the extent to which ideas are uncommon" (Dean et al. 2006, p. 658), which can be judged quantitatively as a "statistical rarity among more popular solutions" (Thys et al. 2014, p. 367). We assessed *value originality* (Research question 4) through the frequency of a value idea mentioned for one of the three IT products. To this end, we developed a formula which we briefly describe in the following.

First, we determined the percentage of participants that mentioned each idea category i for an IT product, forming the preliminary idea uniqueness score IOS_i. We then computed the mean originality score POS for every participant's value ideas (controlling for overlapping ideas) and defined it so that a higher score signals higher originality. This yields the following formula,

$$POS = 1 - \frac{1}{k}\sum_{i=1}^{k} IOS_i,$$

where k is the total number of the participant's ideas. We chose this approach to avoid an overly strict and binary view of originality (i.e., classifying an idea as either original or not), which would lead to a right-skewed distribution with most people having rather few original ideas. The mean originality score per participant, on the other hand, supports a normal distribution with many people having ideas with a medium originality score and few people having ideas that are highly original or not original at all.

6.6 Statistical Analyses

The dataset under investigation posits several challenges for a statistical analysis. First, the variables of interest which show, e.g., whether participants described beneficial or adverse effects or whether values were associated with these effects, were derived from the same data points, that is, the set of ideas that a participant had come up with. Second, the same participants conducted both the roadmapping task and then the ethics-based product planning. This links the results from the two tasks and does not allow the application of models that assume independence. Because of these challenges, we focus on descriptive statistics and discuss examples that illustrate interesting findings and differences between the two approaches.

Still, we also conducted a repeated-measures ANOVA to show whether the influence of the product roadmapping

approach and the ethics-based approach (the repeated measurements predictor variable) on each of the outcome variables (adverse effects, fluency, flexibility and originality) was significant. We entered the three IT products that participants had analysed (bike courier app, smart teddy bear, telemedicine system) as additional predictor variables in the mixed factorial ANOVAs to control for the slight differences in set-up between the two study iterations. We conducted all analyses with SPSS (Version 23) and used Bonferroni corrections for post-hoc pairwise comparisons.

We are aware of the fact that the lack of randomization of the order of the two tasks cautions against assumptions of an experimental within-subject design. To mitigate effects of the fixed order (first roadmapping, second ethics-based approach), we invested serious efforts by correcting for any overlaps within the set of ideas that the participants had come came up with. We thus hope to have created quasi-independent sets of ideas for every participant that make a cautious interpretation of the statistical comparisons worthwhile.

7 Results

Overall, the participants came up with 394 ideas for the bike courier app and 916 ideas for the smart teddy bear. The product roadmap yielded only 24.4% of the ideas for the bike courier app and 26.2% of the ones for the smart teddy bear. Teams working on the telemedicine system came up with 809 ideas, of which 38.6% stemmed from the product roadmap analysis. We provide an overview of the descriptive statistics for all parameters in Table 2. The results of the repeated-measures ANOVAs indicate highly significant differences between the two tested approaches in all parameters of interest ($p < 0.001$). The details of the statistical effects are provided in Table A7 in the appendix and should be interpreted with necessary caution and the underlying lack of randomization in mind.

7.1 Nature of Ideas

In the product roadmap, the participants neutrally listed what should go into the product or service: more than half of the product roadmapping ideas (55.1%) were coded as neutral product characteristics (e.g., "scheduling function" or "search engine for information"). At the same time, 44.9% of the ideas described a positive value of the technology (e.g., "ease of use", "IT security", or "efficiency & optimization") or a beneficial effect for the stakeholders (e.g., patients' "hopefulness" to receive good and fast treatment).

Figure 3 shows the mean number of adverse effects reflected in all participants' ideas, excluding ideas that a participant mentioned repeatedly. While a lower concern for adverse effects in product roadmapping is not surprising, we did not expect that participants would not acknowledge *any* potential adverse effects in their product roadmaps. On the other hand, the ethical product planning based on utilitarianism, virtue ethics, and deontology resulted in an average of ten potential adverse effects ($M = 10.02$, $SD = 4.27$). For example, participants thought of "privacy" issues, but also reflected on the stakeholders' emotional well-being when enlisting "exhaustion" and the feeling of "powerlessness" as well as other abilities that suffer such as a decreased "awareness and attention" of the

Table 2 Overview of means per participant separately listed for IT product and approach

	Bike courier app ($N = 12$)			Smart teddy bear ($N = 24$)			Telemedicine system ($N = 18$)			Total ($N = 54$)		
Parameters	Mean	*SD*	SE	Mean	*SD*	SE	Mean	*SD*	SE	Mean	*SD*	SE
Product roadmap												
Adverse effects	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Stakeholders	1.42	1.38	0.40	1.58	1.25	0.25	3.94	1.80	0.42	2.33	1.85	0.25
Value fluency	3.92	1.88	0.54	4.37	1.91	0.39	7.72	6.92	1.63	5.39	4.52	0.62
Value flexibility	1.75	0.62	0.18	1.96	0.62	0.13	2.50	1.10	0.26	2.09	0.85	0.12
Value originality	0.21	0.16	0.04	0.35	0.11	0.02	0.30	0.10	0.02	0.30	0.13	0.02
Ethical product planning												
Adverse effects	10.08	4.46	1.29	10.13	4.14	0.85	9.83	4.55	1.07	10.02	4.27	0.58
Stakeholders	6.25	2.38	0.69	4.50	2.00	0.41	4.67	1.94	0.46	4.94	2.15	0.29
Value fluency	19.42	8.17	2.36	16.12	6.52	1.33	18.89	6.13	1.44	17.78	6.83	0.93
Value flexibility	4.42	0.79	0.23	4.08	1.28	0.26	4.50	0.92	0.22	4.30	1.08	0.15
Value originality	0.59	0.07	0.02	0.62	0.09	0.02	0.58	0.06	0.01	0.60	0.07	0.01

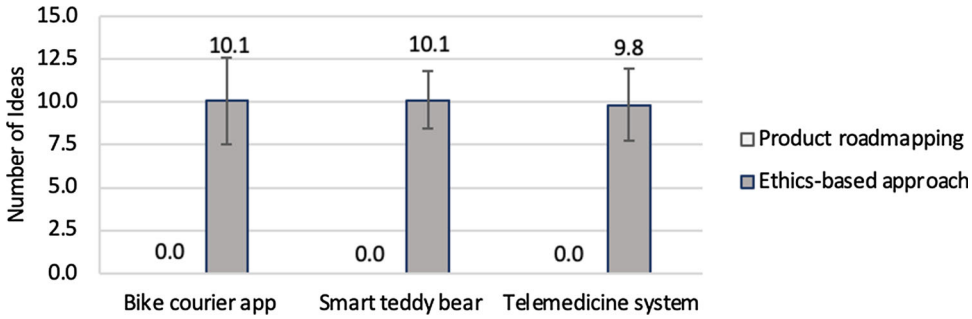

Fig. 3 Means with 95% confidence intervals for corrected number of ideas describing adverse effects for the three IT products, comparing product roadmapping to the ethics-based approach

bike couriers or a child's "creativity" that is held back when constantly playing with a digital toy. These results indicate that product roadmaps seem to support an overly optimistic view on technological advancements. A closer look at the three ethical perspectives shows that each perspective identified beneficial and adverse effects in a roughly balanced way, while they rarely led to neutral ideas.

We also examined how many stakeholders a participant mentioned in their idea descriptions. On average, participants mentioned two stakeholder groups ($M = 2.33$, $SD = 1.85$) in the product roadmapping task and five *additional* stakeholder groups ($M = 4.94$, $SD = 2.15$) in the ethics-based task. We also noted that participants analysing the telemedicine system mentioned notably more stakeholder groups overall ($M = 4.31$, $SD = 1.37$). In the following, we present the results of the comparison of the ideas which related either to values or virtues ("value ideas").

7.2 Fluency of Value Ideas

The first creativity aspect that we investigated was whether an ethical framework fosters or hinders creative thinking around values. The results show that the ethics-based approach inspired new value ideas and yielded a higher number of value ideas than product roadmapping, see Fig. 4.

The participants went beyond the mere identification of product characteristics in the product roadmapping approach and also mentioned or implied values. More specifically, the participants came up with an average of five value ideas in the product roadmapping task ($M = 5.39$, $SD = 4.52$), but with 18 *additional* and *new* value ideas in the ethics-based approach ($M = 17.78$, $SD = 6.83$). A total of 85.9% of the ideas resulting from the ethics-based approach referred to values and virtues that could and should be considered when launching the IT product.

A closer investigation of the different ethical perspectives reveals that the participants came up with most ideas in the analysis inspired by utilitarianism ($M = 9.33$, $SD = 4.16$) and the least number of ideas in the deontological analysis ($M = 2.50$, $SD = 1.92$; virtue ethics: $M = 5.94$, $SD = 2.94$).

7.3 Flexibility of Value Ideas Across Value Classes

To assess the participants' creative flexibility, we looked at the number of value classes (i.e., sustainability dimensions) that a participant's value ideas spanned. Again, we excluded the ideas that a participant had mentioned before. Figure 5 shows an increase in flexibility in the ethics-based approach for all three IT products. On average, a participant's ideas covered two sustainability dimensions in the product roadmap ($M = 2.09$, $SD = 0.85$; participants mostly focused on technical, economic, or individual sustainability) compared to four sustainability dimensions when the ethics-based approach was applied ($M = 4.30$, $SD = 1.08$).

For a better understanding of the sustainability dimensions that the participants' ideas covered, Fig. 6 shows how all value ideas (including overlapping ideas) aggregated from the three IT products are distributed across the sustainability dimensions. In terms of the nature of this thought-flexibility, it is noteworthy that both innovation planning approaches uncover economic values such as "efficiency", "high quality service", "job positions & opportunities", etc. Due to its higher fluency, the ethics-based approach yields more economic value potentials in absolute terms (173 value ideas compared to 44), while the relative creative flexibility on this economic dimension is similar for the two approaches (15.1% of all value ideas in product roadmapping compared to 13.7% in the ethics-based approach). Technical values, however, show the expected difference: 61.9% of the value ideas reported in the roadmapping exercise are of a technical nature as opposed to 4.7% in the ethics-based approach. Thus, ethics-based thinking no longer focuses primarily on technological values in terms of "ease of use", "IT security", "durability", "ease of maintenance", etc., but rather opens

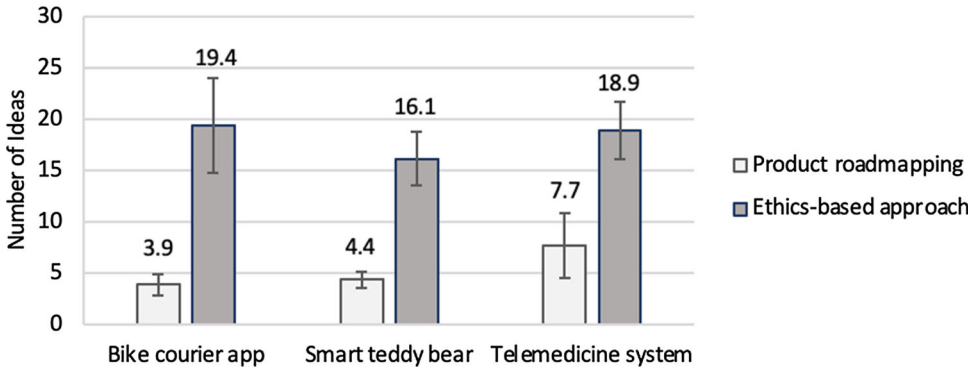

Fig. 4 Means with 95% confidence intervals for corrected fluency of value ideas for the three IT products, comparing product roadmapping to the ethics-based approach

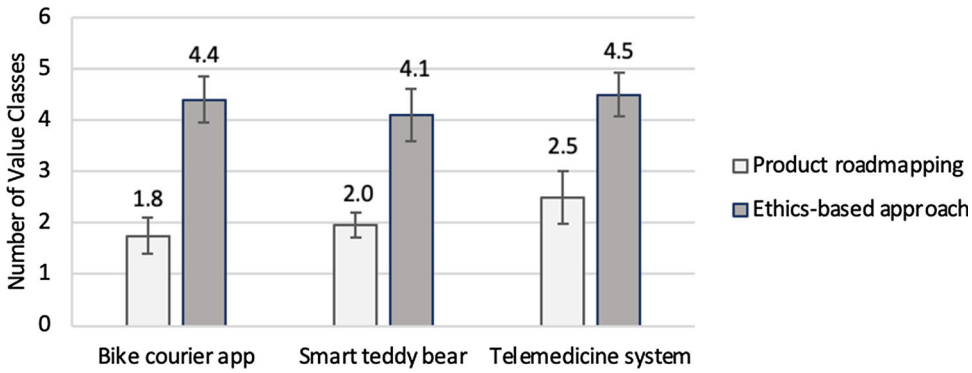

Fig. 5 Means with 95% confidence intervals for corrected flexibility (= number of value classes covered) for the three IT products, comparing product roadmapping to the ethics-based approach

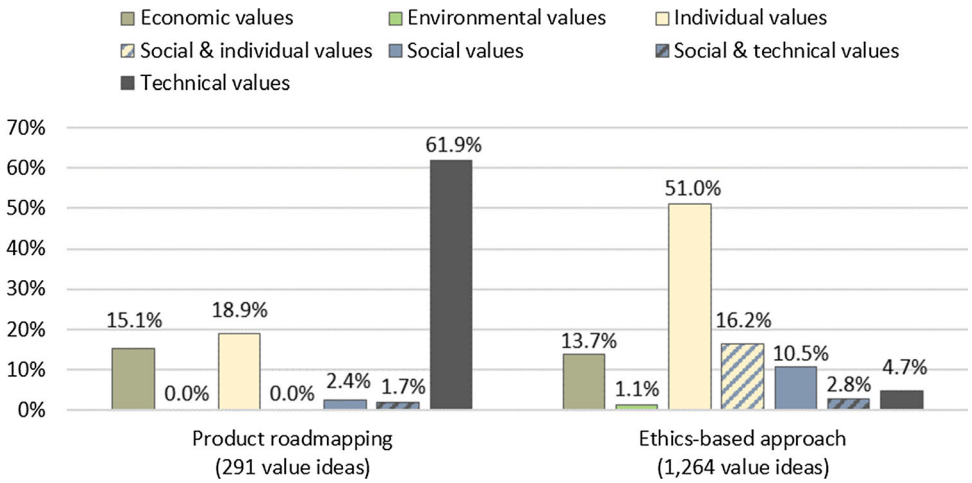

Fig. 6 Distribution of all value ideas aggregated from the three IT products across value classes, comparing product roadmapping (291 value ideas) to the ethics-based approach (1264 value ideas)

up creative flexibility to consider social and individual values that the product caters to or undermines. Consider, e.g., *social values* such as "community", "charity", "co-operation", "family" and "human contact" (e.g., between bike couriers), which make up 10.5% of the value ideas in the ethics-based approach but are hardly recognized in product roadmapping (only 2.4% of value ideas). In addition, ethics-based planning sees many more *individual values* impacted by the technologies (51.0%) than product roadmapping (18.9%): Values such as a gain in "flexibility", "free time", and "control", but also potential losses of "control" or a rise in "corruptibility" are more likely to be recognized when using an ethics-based approach. The average participant spotted only *one* individual value in product roadmapping, e.g., the mainstream value of individual "safety" in the case of the smart teddy bear. Finally, what seems to be a weakness of both approaches is that environmental values are not at all recognized by product roadmapping and hardly recognized in the ethics-based approach (1.1%).

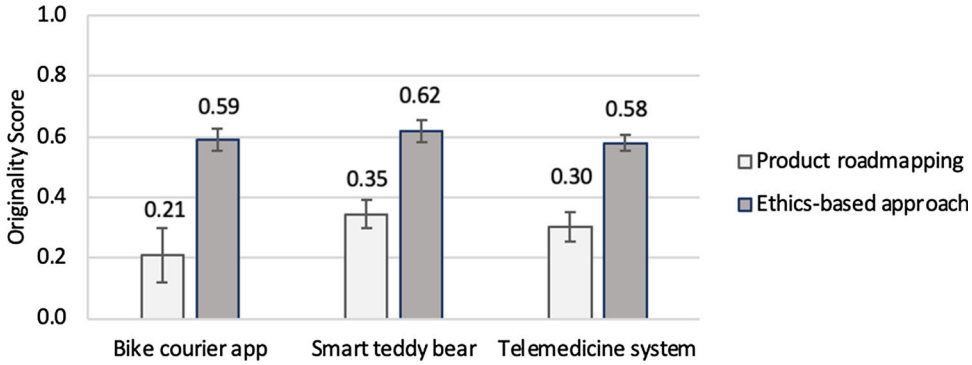

Fig. 7 Means with 95% confidence intervals for corrected originality scores for the three IT products, comparing product roadmapping to the ethics-based approach

7.4 Originality of Value Ideas

To assess originality, we looked at the rarity of value ideas that the individual participants came up with for every IT product. The product roadmap approach resulted in a mean originality score of 0.3 (M = 0.30, SD = 0.13), whereas the ethics-based approach yielded a mean originality score of 0.6 (M = 0.60, SD = 0.07). These numbers signal that an average idea resulting from the product roadmap was mentioned by 70% of all participants (0.70 = 1–0.30). Representative value ideas for this level of originality are "efficiency & optimization" for the telemedicine system and the bike courier app and "ease of use" for the smart teddy bear. On the other hand, an average idea resulting from the ethics-based approach was more original, put forward by less than half of the participants (0.40 = 1–0.60). Representative examples here are "patience" in the telemedicine case, "human contact" for the smart teddy bear, and "job positions & opportunities" for the bike courier app. Figure 7 shows a more pronounced increase in original ideas when the ethics-based approach was used with the bike courier app than in the other two cases.

Looking at the three ethical analyses in the ethics-based approach, we see higher originality arising from the virtue ethical analysis (M = 0.67, SD = 0.10) and deontology (M = 0.69, SD = 0.22), than from utilitarianism (M = 0.54, SD = 0.12). This shows that varied dimensions of human character and behaviour such as "gratefulness" and "tactfulness" (each mentioned by less than 10% of participants) can inspire unique ideas for product innovation. In contrast, the product roadmap inspired more common ideas; for instance, "ease of use" was mentioned by at least 75% of the participants. Across the three IT products, "IT security" was the most frequent value idea.

8 Discussion

In two consecutive studies, we used mixed-method analyses to explore the ideational output from traditional product roadmapping and ethics-based product planning in terms of value ideas. The results consistently underscore the creative value potential of the ethics-based approach, yielding significant differences for all three value creativity parameters we compared across the two innovation planning approaches. Our findings show that the ethics-based approach can add an ethically grounded value framework to traditional innovation practices, leading to the new approach "value-based roadmapping".

8.1 Ethics Inspires Creative Ideas for Value-Oriented IT Innovation

Our results provide several insights into the individual participants' creative thinking in terms of values. First, the ethics-based approach yielded an average of 23 value ideas, which is more than four times the average five ideas gained from the traditional product roadmapping. For the bike courier app, the ethics-based product planning yielded five times as many value ideas as the product roadmap. Second, we considered the nature of the participants' ideas by looking at the different value classes (social, individual, technical, economic, environmental) that they span. As expected, participants focused on technical and economic values in the product roadmap. When using the ethics-based approach, participants showed a higher flexibility when thinking about values and covered more than two additional value classes, opening up innovation ideas that also spanned social and individual values. The third creativity aspect we investigated was the originality that the two approaches led to, i.e., the infrequency of a value idea among the pool of ideas generated for each IT product. Again, the ethics-based approach inspired the participants to think outside the box and come up with value ideas that target context-specific stakeholders and interactions rather than the mainstream values that the product roadmap

approach elicits. This is demonstrated by an originality score that was more than twice as high in the case of the bike courier app.

We also made several important observations beyond the scope of the creativity parameters. We observed that the ethics-based approach fostered values in IS beyond the mainstream values that found their way into traditional product roadmaps: Most intrinsic values (91.89%) that the participants came up with were elicited by the ethics-based approach, e.g., "dignity", "freedom", or "personal growth". The ethics-based approach also acknowledged the technologies' impact on virtues such as "courage", "integrity" and "self-discipline", as well as on vices such as "greed", "jealousy", and "loss of patience". Lastly, the ethics-based approach helped participants to acknowledge potential adverse effects for a broader set of direct and indirect stakeholders.

Overall, the three IT products under investigation show similar patterns across the different parameters, which supports the applicability of an ethics-based and value-oriented product planning approach for technologies with different physical setups, purposes, and contexts. Still, the smaller number of participants working on the bike courier app might have made it easier for them to come up with ideas that few others in the group also thought of, resulting in higher originality scores for this product.

8.2 Towards "Value-based" Roadmapping

Our results are of high relevance for current practices in companies that still follow traditional product roadmapping and focus mainly on technology and direct customers as stakeholders. Recent criticism has emphasized that the traditional product roadmap approach needs to change in order to be able to accommodate current requirements (Münch et al. 2018). Our findings are in line with this criticism and suggest "value-based roadmapping" as a potential extension of traditional approaches.

Understanding product evolution as mainly driven by competitive technological developments constrains creative innovation by linking it only to economic and technical values. What is more, results show that corporate innovation planning practices need to explicitly consider possible harms. Across the three IT products that were analysed, the product roadmap did not capture any of the potential adverse effects, whereas the ethics-based approach yielded a total of 121 adverse effects for the bike courier app, 243 for the smarty teddy bear, and 177 for the telemedicine system. This shows that product roadmaps support an overall optimistic long-term view on information systems and ignore the variety of potential adverse effects (Gimpel and Schmied 2019). Lastly, a diverse set of stakeholders should be considered. Traditional product roadmap approaches often limit stakeholders to direct customers (Albright and Kappel 2003), company stakeholders (Cosner et al. 2007), or prominent stakeholders from industry, academia and the government (Jeffrey et al. 2013). The ethics-based approach that we employed acknowledged an additional set of stakeholders, covering important stakeholders such as society and community.

Companies that manage their incremental technical product evolution internally are confronted with the question of what strategic role they should assign to the product roadmap. We argue that product roadmaps should be complemented by an ethics-based focus on values *before* managers decide what the development team should work on. As in our study setup, product roadmapping can sketch out an initial operational concept for a system of interest that is reviewed and refined with the help of an ethics-based approach with a focus on values. Even better, the two approaches could be applied in an iterative way to account for the dynamic environment of current technology innovation. This does not mean that all identified values must end up in the final product roadmap. Rather, they should be considered throughout the product innovation planning process. Our results suggest that such a combined "value-based roadmapping" approach can be hugely beneficial for companies.

We argue elsewhere that values need to be *elicited* from the technology's context (Bednar and Spiekermann 2022). Still, we believe that the detailed description and classification of the 187 value categories that emerged from the participants' ideas for the three IT products with different use contexts (see Tables A4, A5 and A6 in the appendix) can be used as an inspirational source for future value-oriented projects and innovation planning practices.

8.3 Implications for Theory and Research

While we focus on traditional product roadmapping versus an ethics-based approach to identify values in the innovation planning process, our findings are also relevant for related methods and research areas. Specifically, we want to discuss the implications for two recognized approaches, i.e., VSD (Friedman and Hendry 2019), a reputed value-oriented approach that emerged in the 1990s, and design thinking (Brown 2009), a human-centered, iterative, and creative problem-solving approach that focuses on human needs.

First, incorporating the concept of values in design thinking offers several advantages over solely focusing on human needs. Needs form a common concept in design approaches that seek to put the human into focus (Norman 2013). However, any method focusing on needs restricts itself to satisfying potential deficits or desires that are derived from them. Ethically driven IT innovation,

however, should go beyond such a restricted view and aim at what is morally good. In line with this, an ethically framed concept of values can accommodate such an overarching perspective. Values represent what matters to humans, what they strive for and seek to protect, and thus extend to moral considerations (Fuchs 2020). The results of this study suggest that values can help to align the design of technological products with societal concerns, promote long-term sustainability, and have a positive impact on affected stakeholders. By considering values, designers gain a holistic view on a technology's implications that takes into account an individual's desire for health, privacy, and safety, while also addressing broader moral principles such as tolerance and responsibility. What is more, in contrast to needs, values can serve as ethical guidelines for decision-making in the IT innovation process, ensuring responsible product development and preventing unintended harm.

Second, our findings support the combined application of different ethical perspectives for a holistic view of a technology's possible implications. In a recent publication, VSD scholars Friedman and Hendry (2019) stress that *any* ethical theory can be used for the value elicitation phase in VSD projects. Our results show that this position has some merit, as all ethical theories have an embedded idea of what is important for morally judging a situation and can thus help to identify values that are relevant for a technology. However, we argue that the combination of several ethical perspectives is most fruitful for an ethically aligned and creative innovation planning process (Bednar and Spiekermann 2022). More than half of the VSD projects and studies considered in a recent review included an analysis of harms and benefits (Winkler and Spiekermann 2021), implying an underlying utilitarian reasoning. In our study, we find that utilitarianism is the best method to foster value fluency. However, utilitarianism is not suited to anticipate how a technology affects the long-term character and behaviour of stakeholders. Will patients become impatient when they are used to always being able to reach a doctor online? Will doctors become jealous of their professional peers if they are not ranked highly on the telemedicine platform? What will constant digital companionship from early childhood do to the courage of children once they are without their digital friend? A total of 44 out of the 47 virtues (93.6%) identified for the three technologies were uncovered by the virtue ethical analysis. Virtue ethics was also a main driver of the significantly higher originality achieved in the ethics-based approach. The third ethical perspective, deontology, added a few additional and original value ideas. Deontology also contributed unique values such as "self-care" or "better world" and was especially sensitive to adverse effects. From these findings we conclude that an ethical framework for values should include a heterogeneous set of ethical theories to avoid missing out on relevant aspects.

While our results show that an ethics-based approach uncovers a broad range of relevant values, we also found a limitation: the participants ignored the impact that the three technologies could have on the environment. Only one environmental value was detected in the utilitarian analysis of the bike courier app, where a greener city was envisioned in which bikes rather than motorized vehicles are used to deliver food. This is a meagre result in times of abounding environmental discussions. The participants could have thought about the digital waste that is created when analogue products are digitalized as in the case of the smart teddy bear, or the CO_2 emissions caused by the many AI functionalities they envisioned. Whether nature was not considered because of our instructions or the choice of ethical theories remains unclear. Future research could further investigate the different aspects that ethical theories address (and neglect) and thereby not only form an interesting follow-up study, but also contribute to the wider discussion of the use of ethical theories for technology design (Jacobs and Huldtgren 2021).

8.4 Limitations and Future Research

The students participating in our study attended over 2000 h of lectures in management and IT. Still, we acknowledge that a student sample is a potential weakness. In corporate practice, subject matter experts with insight into customer values and the respective industry heavily influence product innovation planning. We hope that promising results like the ones we present on the real-world case of a telemedicine system can motivate corporations to engage in an ethics-based value-oriented product innovation project. This would complement our results with insights from experienced managers and their teams across industries.

Regarding the overall study design there are both benefits and drawbacks to the team setup and the use of an online interface to note down ideas as used in the second iteration of the study. The participants worked in teams so that they could exchange ideas and reach consensus on (ethical) risks and benefits. Still, it is difficult to estimate how the internal alignment of ideas affected the decisions-making and reasoning within each team. We acknowledge that the focus on individual creativity versus creative collaborative processes constitutes a fundamental difference for underlying creativity dynamics (Wang and Nickerson 2017). We cannot show whether the creative output profited or decreased due to team dynamics. Also, following the idea that digital tools can help to counteract weaknesses of real-world practices (Gabriel et al. 2016), we designed an online interface for the second study iteration to provide a less restricted form for noting down ideas than the

table that was used as a template in the first iteration. This interface presents a very simple form of a creativity support system, which can support creative processes beyond the ideation phase in various ways (Gabriel et al. 2016). As the influence of the digital tool was not the focus of our research, we cannot provide insights into how the use of the interface affected how participants conducted the task. However, differences between the two study iterations are indirectly analysed as differences between the three IT products, which did not yield any significant main effects, except for originality (see Table A7 in the appendix).

Furthermore, we acknowledge that any measurement of creativity is a challenge. Our approach followed previous empirical research on creativity, which used multiple indicators to assess the creativity of a person or product (Batey 2012). We employed an objective measure for the three creativity aspects fluency, flexibility, and originality, because the vast number of ideas that we evaluated (more than 1500) was not suited for rating methods such as consensual assessment techniques (Amabile 1982). There are diverse theories and models for creativity, and every operationalisation reflects a specific and thus limited theoretical view of creativity (Wang and Nickerson 2017). For example, it has been debated whether originality is the main aspect of creativity. Puccio and Cabra (2012) argued that "true creative behaviour involves a balance, tension or synthesis between originality and usefulness" (p. 191). We believe that the creativity indicators we developed in this study are a noteworthy achievement for a quantitative operationalization of creativity in innovation planning. Yet, we are also aware of their limits and welcome future research that follows a different operationalization, e.g., highlighting the usefulness aspect.

Finally, a potential third limitation is the within-subject design, which can cause carry-over effects for the participants who analysed each technology twice but employed different methodologies. We want to stress that we mitigated such effects by placing several weeks between the innovation planning tasks and strictly controlling for all idea overlaps. We also want to emphasize that our research aim goes beyond a mere *comparison* of methods. As argued above, product roadmapping will continue to be an important part of product innovation planning. We highlight that traditional innovation practices can be enriched by *additional* practices with a value focus. Our findings reveal that such a complementary approach can foster more ethically aligned and creative ideas in the innovation planning process.

9 Conclusions

The digital transformation of the economy pressures companies to come up with convincing value propositions for investors and customers and defend a competitive position in an environment of start-ups that want to digitally disrupt existing markets. While the need for creativity in this environment abounds, innovation planning needs to accommodate not only hyped technological advancements, but also morally relevant values. In a two-study mixed-method research project covering three IT products – a digital toy, a food-delivery app and a telemedicine system – we show how traditional product roadmapping practices are limited in the extent to which they can achieve this, as they focus too much on technology strategy and an abstract user market. In contrast, the ethics-based approach that we investigated as a potential addition to traditional product roadmapping employs the perspectives of utilitarianism, virtue ethics, and deontology to foster creative and ethical thinking in terms of values and sensitivity to potential stakeholder harms. The results of both our quantitative analyses and our qualitative insights support current developments in the IS field such as the new ISO/IEC/IEEE 24748–7000 standard on ethical system design. These developments emphasize the important contribution that ethical perspectives and concepts can bring to IT design and innovation. In our study, the participants came up with more than three times as many value ideas in the ethics-based approach as compared to product roadmapping. They were also more flexible in their value thinking, acknowledging more value classes linked to sustainability dimensions including individual and social values. Moreover, they were more original, departing from mainstream values such as IT security or ease of use to also uncover unique value ideas, for instance, on how to foster community, flexibility, or human contact. Unlike the traditional product roadmapping approach, which elicited ideas related to values with a technical and economic focus (e.g., IT security or efficiency), the participants acknowledged higher principles (e.g., freedom or personal growth) in their ethical product planning. Our results not only provide insights into the creative power that can be unleashed by taking different ethical perspectives on values in specific technology contexts, but also show the usefulness of a quantitative operationalization in evaluating and comparing innovation methods in terms of creative output. What is more, we hope that our elaborate methodological approach using both qualitative and quantitative analysis methods can support future value-oriented system design projects. The detailed category system we provide might be an especially useful example for an inventory of values which can be used as a reference by IS researchers, scholars, and practitioners.

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