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The co-creation of values-in-use at the front end of infrastructure development programs

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Abstract

There has been recent academic interest in programs as value creation processes. Scholars focus particularly on the front end of programs as opportunities for clients to create value. At the front end, client and market partners can actively co-produce value through co-creation sessions. This paper investigates what stakeholders do in co-creation sessions and how this contributes to the co-creation of value at the front end of programs. We used an action research approach combined with participant observation, document analysis, and interviews with participants to study stakeholder engagement in co-creation sessions at the front end of a Dutch infrastructure development program. The findings show that the client intended to realize a value (value-for-firm) that was competing with market partners' values. By engaging in co-creation sessions with the client, market partners and knowledge partners co-created three sets of values (value-in-use) as follows: commercial, intellectual and collaborative values. The findings contribute to the academic debate on value creation in programs with an in-depth understanding of co-creation sessions at the front end.

Keywords: Co-creation, value creation, front end, program, action research, infrastructure development

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Abstract

There has been recent academic interest in programs as value creation processes. Scholars focus particularly on the front end of programs as opportunities for clients to create value. At the front end, client and market partners can actively co-produce value through co-creation sessions. This paper investigates what stakeholders do in co-creation sessions and how this contributes to the co-creation of value at the front end of programs. We used an action research approach combined with participant observation, document analysis, and interviews with participants to study stakeholder engagement in co-creation sessions at the front end of a Dutch infrastructure development program. The findings show that the client intended to realize a value (value-for-firm) that was competing with market partners' values. By engaging in co-creation sessions with the client, market partners and knowledge partners co-created three sets of values (value-in-use) as follows: commercial, intellectual and collaborative values. The findings contribute to the academic debate on value creation in programs with an in-depth understanding of co-creation sessions at the front end.

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1. Introduction

Increasing academic attention has been devoted to fully understanding the value creation process in the context of programs (Martinsuo and Hoverfält, 2018; Thiry, 2004, 2002; Winter and Szczepanek, 2008). A program is defined as "a group of projects which contribute to a common, higher order objective" (Turner, 2014: 324). Programs are often regarded as large-scale projects (Morris, 2013), as strategic and long-term undertakings (Pellegrinelli, 2002) and as complex and uncertain endeavors (Artto et al., 2009). Although the conceptualization of programs in the project management literature has been diverse over the years, scholars have come both to cherish the value-oriented, integrated multi-project character of programs and to understand their context-specific management requirements (Martinsuo and Hoverfält, 2018).

A program's front end is primarily understood to be important in the sense-making of stakeholders' needs and in the specifying of the benefits and values that programs are intended to deliver (Thiry, 2004, 2002). At the front end of programs, the tensions, and interests of stakeholders can be identified to define and determine the value of programs (Thiry, 2004). The value creation process is understood to be related to the source and target of value creation (Lepak et al., 2016), which have two sides: the firm and the user (Gupta and Lehmann, 2006). Value-for-firm is the value that a firm has realized, while value-in-use is realized when the user uses a product or service (Grönroos, 2011; Vargo and Lusch, 2008, 2004). Value creation is thus seen as part of a process in which stakeholders work together and influence one another, creating opportunities for synergy (Gardiner, 2014). This draws our attention to the practices and mechanism through which values are bestowed upon objects and services (Kornberger et al., 2015).

There has been scant emphasis on the importance of co-creation sessions at the front end and on programs for creating value (Keeys and Huemann, 2017; Näsholm and Blomquist, 2015). Co-creation can be described as an interactive practice in which users actively contribute their ideas to create—jointly with

suppliers—value to an object (Prahalad and Ramaswamy, 2004). In program studies, co-creation has been explored as a strategic approach to programs (Mills and Razmdoost, 2016; Näsholm and Blomquist, 2015). They stated that co-creation could help harness creativity and engagement in programs and better adapt to changing stakeholder expectations. Though Although co-creation has been explored as a strategic approach to program management (Mills and Razmdoost, 2016; Näsholm and Blomquist, 2015), its contribution to or limitations on value creation in programs' front end remains underexplored (Smyth et al., 2018).

With this paper, we respond to the call for a deeper understanding of value creation at the front end of programs (Martinsuo and Hoverfält, 2018; Smyth et al., 2018; Winter and Szczepanek, 2008). Martinsuo and Hoverfält (2018) emphasized the importance of studying value creation in programs and name this one of the most promising research directions in program studies. Therefore, this study investigates what stakeholders do in co-creation sessions and how this either contributes to or limits the co-creation of value at the front end of programs. Formulating our aim into a question, we ask: *How does co-creation contributes to or limit the creation of value at the front end of programs*?

To answer this query, we draw from an in-depth case study of co-creation sessions at the front end of the Multi Water Works (MWW) program, a large program of Rijkswaterstaat (RWS), the executive body of the Dutch Ministry of Infrastructure and the Environment, for the replacement and renovation of 52 ship locks over the next 30 years. An in-depth case study is an excellent research method to understand organizational complexity (van den Ende and van Marrewijk, 2018). We selected the case based upon the criteria of the size of the program, the focus on the front end, and the access and focus on value creation in which stakeholders participated equally. We adopted an action research methodology (Delhi, 2003) that included participant observation during four co-creation sessions and interviews with 14 participants to collect data. The findings in this study show that co-creation sessions generated three sets of value-in-use: commercial, intellectual, and collaborative values. The academic contribution of these findings to program studies is threefold. First, we respond to the academic call for understanding value creation at the front end

of programs (Martinsuo et al., 2018) with an in-depth study of co-creation sessions. Second, we used literature on firm-user interaction for product and service value creation (Goel and Yang, 2010; Gosselin and Bauwen, 2006) to theorize the co-creation process in programs and identified three sets of value-in-use co-produced by stakeholders at the front end. Third, while other publications focus upon value creation among few stakeholders (Artto et al., 2016; Winter and Szczepanek, 2008), we present a case with a broad coalition of the client, market partners, and knowledge partners.

The paper is structured as follows. First, we start with a brief review of the literature on programs and the value creation process. Then, the literature on the front end of programs is discussed, showing the front end as the most significant opportunity for creating value. In the final part of the theoretical section, the concept of co-creation that integrates different actors' knowledge sets is explored. Second, the research method of action research and data collection instruments are discussed. Third, the empirical findings start with a detailed case description of the MWW program, after which three sets of created values are presented. In the discussion session the findings are conceptualized, and finally, conclusions are drawn and attention is given to theoretical contributions and managerial implications.

2. Theoretical framework

2.1 The subjective nature of values in programs

There has been increasing interest in values in programs, as traditional project management has been criticized for focusing too much on on-time delivery, budget, and satisfying requirements (Winter et al., 2006; Winter and Szczepanek, 2008). Programs have been suggested as value-creating processes (Winter and Szczepanek, 2008) and are generally understood as "collections of projects having shared goals and objectives and resources all of whose benefits must be realized for the overall program to work" (Morris, 2013: 234). While some scholars notice that the differences between major or megaprojects and programs are difficult to identify (e.g., Morris, 2013), others argue that programs cannot be regarded as scale-ups of projects (Lycett et al., 2004). Programs have broad and fuzzy goals (Artto et al., 2009) that are linked to

the strategy of the organization (Pellegrinelli, 1997). In sum, programs are understood as strategic endeavors for creating value.

Although there is little academic definitional agreement (Lepak et al., 2016), value has frequently been defined as a representation of the cost-benefit relationship from an actor's perspective (Laursen and Svejvig, 2016). Value is understood to be subjective and multifaceted (Chang et al., 2013; Kornberger et al., 2015) and can be symbolic (Van Marrewijk, 2017). Martinsuo et al. (2018) distinguished financial, social, regional, ecological and comparative values in their study on the framing of value at the front end of three infrastructure megaprojects. Value is thus negotiated, constructed and created between stakeholders at the front end of programs. To enrich this debate, we turn to the literature on firm-user interaction for product and service value creation (Goel and Yang, 2010; Gosselin and Bauwen, 2006).

Value is created for two sides, the user and the firm (Gupta and Lehmann, 2006), and can include both monetary and nonmonetary and both direct and indirect value (Thiry, 2004). Value-for-firm is perceived as a prerequisite for value-in-use (Goel and Yang, 2010; Gosselin and Bauwen, 2006). The firm-user interaction influences value-in-use in two ways. First, this interaction provides the firm with opportunities to identify, understand and highlight users' needs and points of view (Vargo and Lusch, 2004). The firm can potentially can customize its offerings (Payne et al., 2008), which in turn enhances value-in-use for the user (Heinonen et al., 2010). Second, this interaction allows users to potentially maximize their future value-in-use by co-producing products and services together with firms. We see great potential for applying these insights to the front end of infrastructure development programs in which the client and market partners co-create values.

2.2. Front end of programs as an opportunity for creating value

The front end has been understood as the most significant stage for opportunities for creating value in programs (Edkins et al., 2013). It is in this phase that the strategic intent of the organization to define specific values in programs is considered. How the front end matters to programs' performance has been

widely discussed in the academic literature (e.g. Pellegrinelli, 2002; Rijke et al., 2014; Winter and Szczepanek, 2008). There is a growing academic recognition of uncertainty at the front end of programs (Lehtonen and Martinsuo, 2008; Martinsuo and Lehtonen, 2007), rendering the formulation of programs highly ambiguous (Thiry, 2004). Scholars agree that the lifecycle of programs is neither linear nor predefined and that programs will emerge and evolve (Martinsuo and Kantolahti, 2009). Therefore, Thiry (2004, 2002) asked for the attention of the programs' front end to collectively make sense of the requirements and needs of programs. Based upon such a front end of analysis the strategy and scope, that values that programs intend to deliver are specified (Martinsuo and Lehtonen, 2007). In this way, the front end can create the image of programs (Thiry, 2004). In sum, a good definition of programs' value is regarded as essential for value creation.

Programs have been used as vehicles for infrastructure development contexts (Eweje et al., 2012; Rijke et al., 2014). For example, Rijke et al. (2014) proposed programs to provide the client with more space for dealing with change for developing infrastructures. Front-end activities of defining values and describing how these values can be captured substantially improve the success of program execution. Accordingly, clients tend to involve their contractors in projects and programs as early as possible to have conversations about their goals and intentions before contracts are signed (Matinheikki et al., 2016). This commitment of client organization and contractors to the project's goals forms the basis for their cooperation (Ring and Van de Ven, 1994). Thus, they can come to a better understanding of program details, the allocation of risks and the terms for cooperation. However, Samset and Volden (2016) suggested that both client and market partners have learned little from working at the front end of projects. Therefore, learning capability is required during the front end (Samset and Williams, 2010).

2.3. Co-creation and project studies

Co-creation is a management initiative that brings different partners together to jointly produce a mutually valued outcome (Prahalad and Ramaswamy, 2004). With its roots in business studies, co-creation can be

defined as “the joint, collaborative, concurrent, peer-like process of producing a new value, both materially and symbolically" (Galvagno and Dalli, 2014; 644). Co-creation thus provides a value creation framework centered on service (Grönroos, 2011; Vargo and Lusch, 2008) in which both firms and users are involved. Mahr et al. (2014) highlighted the importance of integrating different actors' knowledge sets and engaging in mutual explorative and exploitative learning. This is in line with Grönroos and Voima (2013), who insisted on direct, face-to-face contact for co-creation. These developments resulted in Kleinsmann et al.’s (2010) understanding of co-creation as practices in which multidisciplinary participants combine and integrate their knowledge and resources to create value in the design and production stages jointly.

In the past decade, scholars have shown an increasing interest in applying the concept of co-creation at the project level (Eriksson et al., 2017). The concept has been applied to engage different stakeholders, such as client and market partners and other participants, in the process of creating value (e.g., DeFillippi and Roser, 2014; Eriksson et al., 2017; Heredia Rojas et al., 2018; Roser et al., 2013). Co-creation has positive impacts on project performance (Heredia Rojas et al., 2018) and shapes the benefits of sustainable development (Keeys and Huemann, 2017). Co-creation is used to enhance explorative and exploitative learning in the building and infrastructure industry (Eriksson et al., 2017). For example, co-creation has been used by clients hiring engineering firms to jointly learn about the management of complex projects (Smits and van Marrewijk, 2012). To strategically position itself in niche markets, co-creation can be employed as hybrid models of more than one type of co-creation practice across processes (Roser et al., 2013). However, stakeholder interaction in the program’s front end cannot guarantee co-creation when there is a lack of integration between the involved organizations (Artto et al., 2016; Mills and Razmdoost, 2016).

3. Research methods

3.1 Research design

To understand the contribution of the co-creation sessions in value creation at the front end of the MWW program, we adopted an action research methodology. This paper defines action research as an engaged process concerned with the development of practical knowing grounded in a participatory worldview (Kemmis, 2006). Action research aims to empower the client, market partners and knowledge partners in their development of a shared understanding of the MWW program.

The advantages of action research are in the high-quality insights gained from close participation in and engagement with the MWW program. Our research team of four consisted of both practitioners and academics. The third author is a part-time RWS employee and assisted the MWW program manager and organized, together with the Bouwcampus, the co-creation sessions; he actively participated in all sessions. The Bouwcampus is a pre-competitive and neutral space at Delft University of Technology campus where public and private partners in the construction industry can reflect on their collaborative work practices (www.debouwcampus.nl). The fourth author was also actively involved in the MWW program to develop new knowledge of lock standardization. Action research scholars perceive knowledge development as a mutual process dominated by engagement and collaborative relationships (Delhi, 2003). Over time, action research has been established as a set of practices through which researchers identify with the researched and through which research is made contextual (Reason and Bradbury, 2008).

The limitations of action research lie in the risks of the researcher's over-engagement with the field and sympathetic interpretation of research findings (Yanow and Schwartz-Shea, 2015). Furthermore, action research is criticized for not producing high-quality ethnographic data (Reason and Bradbury, 2008), while the building of general theory appears to be difficult, as theory is developed in relation to specific local situations (Delhi, 2003). Finally, encouraging real participation and building relationships with participants, along with acknowledging and sharing power with them, is needed to establish credible accounts.

To overcome these limitations and to safeguard academic standards of scholarship (Gioia and Chittipeddi, 1991), we complemented the researcher team with an outsider researcher, the second author, who had not been involved earlier in the study. The outsider researcher went through all the reports, interview data and observational notes. In this way, a more objective analysis of the field data needed to publish "good, solid, critical research" (Söderlund and Maylor, 2012; 691) was ensured.

3.2 Data collection

The research incorporated multiple methods of data collection, including (1) participant observation, (2) desk research, (3) exploratory interviews with informants, (4) a questionnaire and (5) semi-structured interviews. These methods will be discussed here. (1) Two members of our research team participated in the first stream of the front end of the MWW program, helping to address and collect (inter)national studies on lock designing, and participated in the co-creation sessions in the second stream while one of them, the third author, took on the role of theme group leader. All observations and reflections of the two researchers were noted and worked out. (2) The first author collected the second data source through desk research consisting of the public documents about the MWW program published in Tenderned, the Internet portal that announces new tenders of RWS (www.tenderned.nl), and the Bouwcampus website including the minutes and presentation slides of the sessions, the interim versions and final versions of reports prepared for and produced by the MWW program and the co-creation sessions. In this way, more than 20 detailed reports were collected, half of which were lengthy reports based on a large number of interviews and detailed information about critical events in the MWW program. This information was used to prepare the co-creation sessions and understand the history of the program. (3) Two exploratory interviews were executed by the first author with four informants of RWS to reflect upon the field and the observations. Informants can be very valuable for the understanding and interpretation of research findings (Yanow and Schwartz-Shea, 2015). (4) A questionnaire based upon the preliminary findings was designed and sent to all participants. There were approximately 120 attendees in all co-creation sessions,

including representatives at the administrative level from RWS, BNL (the Dutch association of companies in the construction and infrastructure sector) and NLingenieurs (the Dutch association of consulting engineers), and the market level from contractors, engineering firms and knowledge partners. Unfortunately, only 29 respondents accessed the online questionnaire, while only eight were potentially usable. Therefore, we did not use this information for the analysis, only as background information. (5) Based upon all the preliminary findings, a semi-structured interview list was designed and tested with the informants (see Appendix 1). Fourteen interviewees were asked to reflect on how they engaged in and what their experiences were with the MWW program co-creation sessions. Interviewees were selected based upon an equal division between employees from client, market and knowledge organizations (see Table 1). The semi-structured interviews were executed in teams of two researchers to support the researchers' triangulation (Yanow and Schwartz-Shea, 2015). The interviews were conducted in Dutch, with one researcher taking notes that were then transcribed and translated. Semi-structured interviews provide the freedom to explore the ideas and perceptions of the participants in a conversational tone, but also contain fixed topics and predetermined questions that can be compiled to obtain a certain level of standardization (O'Reilly, 2004). The interpretation of the interviews was checked with the interviewees by email contact.

Table 1: Profile of practitioners interviewed

No.	*Partner*	*Years of experience*	*# of sessions involved*	*Theme group leader*
1	Market	23	3	Yes
2	Market	10	4	Yes
3	Market	29	4	
4	Client	31	4	Yes
5	University	4	4	
6	Market	12	1	

7	Market	36	3	
8	Market	22	4	Yes
9	Client	23	3	
10	University	3	3	
11	University	2	1	
12	Client	41	4	Yes
13	Client	25	4	Yes
14	Client	5	1	

3.3 Data analysis

We executed the analysis of the collected data in a three-step process. In the first step of data analysis, the first and second authors read and interpreted text sequences of our data set to assign codes. The perspectives from the insider and outsider researchers were then drawn together to obtain a more in-depth, holistic and enriched view of the co-creation sessions (Yanow and Schwartz-Shea, 2015). Codes were either directly found in the material or constructed from it (Larsson, 2010). Such an analysis, in which data are understood within the context of the case, strengthens claims about actors' interpretations (Yanow, 2005). Four groups of initial codes emerged from this first step: program ambitions, participants' roles, values added, and knowledge developed. In the second step, the literature on programs and value co-creation were consulted by the first and second author to develop an analytical frame, focusing on value-for-firm and value-in-use, to refine these codes. Inspired by the literature, the sub-codes from the four groups were merged and developed into thematic values with the thematic analysis procedure. As a form of 'member-checking' (Yanow, 2005), researchers discussed the thematic codes 'awareness of future work opportunities', 'understanding of each other's interests', 'exchanging knowledge', 'complementary to each other', 'increased mutual understanding', 'continuation of advancing knowledge', 'increasing mutual trust' and 'reassembling of partners in innovative networks' with several key respondents to verify findings. The final step was the building of theory, which involved a final interpretive process through

multiple readings and iterations between tentative assertions and raw data and then drafting successive versions of the text until the present form was determined, which resulted in three sets of value-in-use generated in the co-creation sessions: commercial, intellectual and collaborative values-in-use. These sets will be discussed below, but first, we start by introducing the case and context of the MWW program.

4. Findings: commercial, intellectual and collaborative values-in-use

4.1. Competing values-for-firm and organizing of co-creation sessions

Ship locks play an indispensable role within the Dutch waterway system networks. The RWS department is responsible for the operation and maintenance of a wide diversity of locks (137), the vast majority of which stems from the early 19th century. Over the next 30 years, 52 of these locks need to be replaced, as some are at the end of their life cycle, while others lack capacity. Therefore, RWS bundled the work, in total worth € 2 to 4 billion, in the MWW program. Typically, each lock is newly designed without standardizing the lock components or considering previous lock design experiences. The MWW program has been designed as a 'learning program' to mobilize expertise from the market and knowledge partners to create resilient locks that are adaptive to future technical, economic and environmental developments.

Central to the MWW program, RWS defined the value of standardization to increase flexibility, adaptation, and quality and to reduce the costs of lock replacement. According to many of the respondents, this value conflicts with the value of freedom of market partners to design and implement innovations in the tender and realization phases of the program: "what we had to check was whether the market was willing to accept our needs for standardization in light of their freedom" (reflection of program manager). This conflict is not exceptional, as public and private partners can have competing values (Klijn and Teisman, 2003). Another ambition of RWS was to implement the new market philosophy of 'the Market-vision,' joint development of the government and the construction sector in the MWW program. This philosophy is based on the values of equality, mutual trust, an open attitude, and a willingness to

cooperate between public and private partners (www.marktvisienu.nl). These values are relatively abstract terms that generally change from more abstract to more concrete notions (Veeneman et al., 2009).

To search for these more concrete notions, RWS organized a co-creation session, which took place for eleven months between April 2016 and March 2017 (see Table 2). In the first session, an explanation was given of the future perspective and MWW program: "we did have a few ideas but were eager to know if the market had other suggestions" (participant observation April 21, 2016). The participants first brainstormed about the standardization of locks, after which they were divided into five groups, each to reflect upon a specific theme that should be addressed in the standardization of (parts of) locks. Each group distilled the two most important items from all the themes predefined by RWS, resulting in ten themes. During the second session, RWS explicitly asked which of the market partners endorsed the program's philosophy. This hampered the willingness of at least 30% of the attendees from market partners to actively cooperate in the co-creation sessions (participant observation June 29, 2016). The others continued to discuss the themes in the first session and introduced new themes for the program. The third session focused on the enrichment and further development of the themes, resulting in a sixth theme and corresponding group. At the end of this session, each of the six groups presented their themes, on which participants provided comments, improvements, and ideas. Two smaller sessions were organized separately by the theme group leaders, who were responsible for directing the substantive input of the participants. The purpose of these sessions was sharing and enriching the themes within a panel and agreeing on the ambition level result. In the last session, the six groups worked hard on their themes both to share their results and insights with others and to make the themes presentable at the final meeting. Finally, recommendations for the MWW program were made on six lock components that were suitable for standardization. These recommendations were used by RWS to make a better prognosis of the standardization opportunities and the willingness of the market partners to develop them. The results from the co-creation sessions were shared and available to all market partners at Tenderned.

Table 2: Co-creation sessions for the MWW program

Session	*When*	*Aim*	*Description*
First session	April 21, 2016	Kick off by RWS and general discussion	RWS as the problem owner, starting the brainstorming on standardization of lock components, with the participants exploring possible themes, distilling the most important themes and jointly providing priorities in themes
Second session	June 29, 2016	Equal, open discussions around selected themes	Discussion over the philosophy of the program. Thirty percent of the attendees quit. Others determining themes from the first session, merging the themes into five themes, dividing themselves into five groups
Third session	October 5, 2016	Enrichment of themes	Reducing the social distance between stakeholders. Further elaborating themes, identifying relevant topics for consideration, introducing an extra theme and group
Sub-session	November 8, 2016	Agreeing on the ambition level of the results	Sharing and enriching the themes within the panel, and agreeing on the ambition level result
Sub-session	February 7, 2017	Agreeing on the ambition level of the results	Sharing and enriching the themes within the panel, and agreeing on the ambition level result
Fourth session	March 9, 2017	Common images and recommendations	Making public presentation, receiving feedback, and getting a commitment for six components that were found suitable for standardization

In summary, the competing values-for-firm of standardization and design freedom and the abstract values of equality, trust, open attitude and willingness to cooperate were connected to the front end of the MWW program. By bringing the client, market partners, and knowledge partners together in co-creation sessions (see Figure 1), these values-for-firm were co-produced into more concrete values-in-use. Based

on the interviews and participant observation during the co-creation sessions, we digested three sets of values-in-use: commercial, intellectual and collaborative values (see Figure 2). These more concrete notions of values are discussed below.

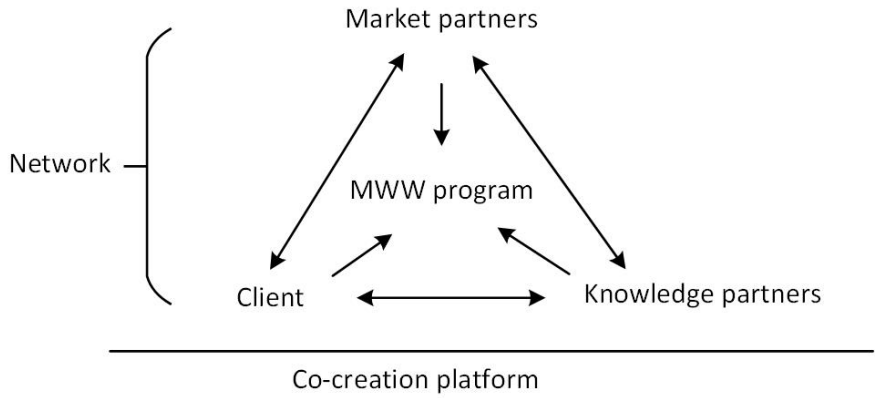


Figure 1. Co-creation sessions at the front end of the MWW program

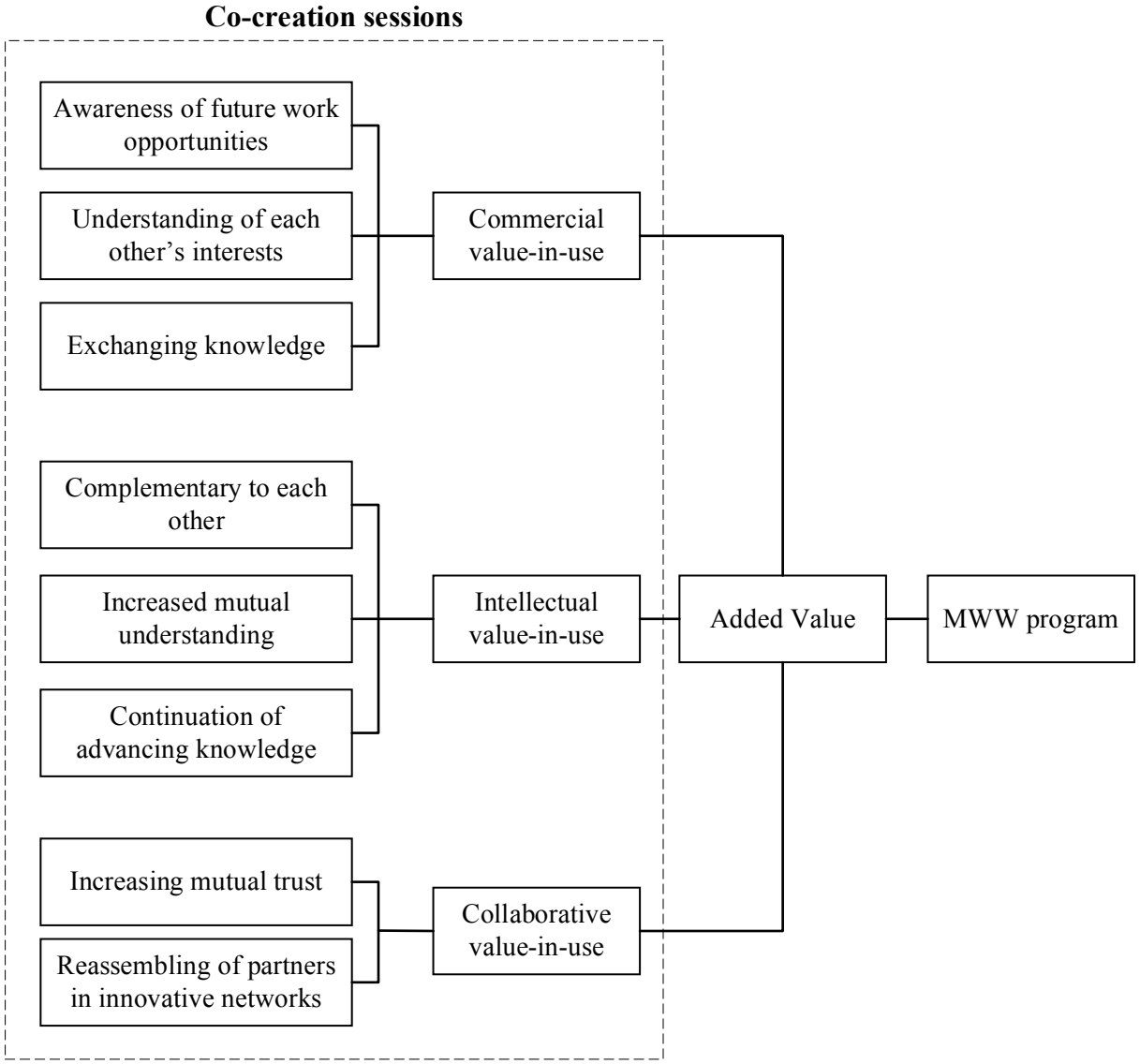


Figure 2 Three value-in-use categories and their sub-contents

4.2. Commercial value-in-use

Related to commercial value, there is an awareness of future work opportunities, understanding each other's interests, and exchanging knowledge. These three values will be discussed here. First, all interviewees showed a high *awareness of future work opportunities* of the MWW program. RWS is the largest client on infrastructure development assignments in the Netherlands, and the market partners heavily rely on how it will carry out procurement of the MWW program. During the sessions, it was

observed that market partners were interested in "what is in it for me." Client participants did not appreciate this future work orientation. As one interviewee stated, "they are [only] willing to work together with RWS because they know that there will be something that is worthwhile for their business" (Interviewee 13). They thought that the market partners came to the co-creation sessions with a double agenda of collaborating and looking for new work assignments. The same interviewee also said, "Probably the market is somewhat restless and very keen on getting a contract for a real project" (Interviewee 13). This attitude of market partners might explain why the first and last co-creation sessions attracted the most attendees; the first sets the scene and the last concluded with a final client decision; therefore, these two sessions are the most important sessions for future work opportunities.

Second, the co-creation sessions also helped stakeholders obtain a better *understanding of each other's interests* in the MWW program. Given their dependent position, the Dutch government accounts for 90% of infrastructural works in the Netherlands (Priemus, 2004), and market partners are very interested in understanding the client's perspective as RWS decides the direction of how the program will be executed. Through their contribution in developing themes, market partners gained an understanding of the program. As one employee from a market partner stated,

> "Most of the time we are falling back into old behavior. You first have to prove your loyalty before the client will think about a more open kind of collaboration. In the end, the contractor is waiting for the client to make the first move" (Interviewee 2).

In addition to the market partners' increased understanding of the client's program, the client gained a better understanding of their partners' interests, opinions and ideas. The co-creation sessions included a much larger audience than in a traditional procurement process, resulting in a larger network. To give one's opinion on the program, interviewees agree that mutual commitment is needed. The interviewees see the many advantages of speaking freely in co-creation sessions, such as "you definitely need a

platform which is absolutely free of judgment" (Interviewee 1). However, some interviewees perceive the sessions to be unclear, as themes were still defined and developed by all parties and it is unknown how the program will be continued. The mutual understanding of interests at the front end helps define the goals of the program.

Third, the interviewees mentioned the positive influence of *exchanging knowledge* as a central value of co-creation sessions. At the front end of an infrastructure development program, the knowledge and solutions developed in previous projects and generated by market partners are very valuable. Ideally, multidisciplinary knowledge is openly shared between the participants to develop the program further. However, this is unrealistic, as knowledge is frequently tacit and valuable to partners. Therefore, participants from both the client and the market partners argued that the exchange of knowledge should be outside of the contract. One of the client employees argues that "in a project, you are bounded by a contract, and in most of the cases contracts are not open, especially when tensions increase" (Interviewee 4). Based on our observations, co-creation sessions provide a 'cheap place' for collecting, validating and verifying information from both the client and the market partners. "I think it is not about gaining. It is about exchanging information and knowledge" (Interviewee 10). This open environment was welcomed as "asks for active participation" (interviewee 7) and "forces the participants to have open communication" (Interviewee 5).

4.3. Intellectual value-in-use

Based on our study of the co-creation sessions, we digested three intellectual values-in-use. First, interviewees acknowledged and we observed during the sessions that market partners and the client can be *complementary to each other*, as they require valuable but different knowledge: client experience, market experience, and scientific research. The client wants to make more effective use of the expertise, knowledge, and potential innovation of the market:

> "It was nice to see that a lot of people with different professions, different knowledge, and different positions within their organization were gathered in one room, and most of the time there was one discussion (item)" (Interviewee 10).

Interviewees were enthusiastic about the diverse and sometimes conflicting understandings of program themes. For example, in the second session, we observed an active phase in which inspirations were obtained from participants' perspectives on sustainability. In contrast to the market partners, the client understood sustainability as a precondition and clear ambition for all the themes in the MWW program. Conflicts over program themes can stimulate discussion and creativity, which can ultimately result in the client engaging in a better decision-making process. Complementary knowledge can develop program themes that satisfy evolving local demands and lead to new work practices in the program. In this way, co-creation sessions developed smart ideas and concepts for a better definition of the MWW program.

Second, we have observed how the sessions *increased mutual understanding* among the participants involved. Interviewees claimed that "by performing in co-creation, a better understanding in each other's interest has been achieved, which encouraged a further collaboration even more" (Interviewee 3). Frequently, the term 'looking in each other's kitchen' was mentioned, indicating that it was good to understand each other's interests, work practices, and cultures: "it is all about the process: understanding used methodologies, knowing the context, learning about the language of the other" (Interviewee 1). For example, exploring how market partners understand standardization can be useful for the lock owner, lock designer and lock builder. Learning from these experiences leads to a better understanding of the possibilities and processes of standardization. The challenge of the co-creation is that most submissions are not very useful, not practical and difficult to implement. Some comments from the market partners argued that a shared understanding is needed: "the sessions provide the ability to empathize and to discuss freely possible solutions. So in the end, we all have a better understanding of the clients' problem" (Interviewee 2). The participants emphasized co-creating capabilities that will integrate interdisciplinary

knowledge and research, treating stakeholders as the source of knowledge for finding problems and solving problems, emphasizing the completion of design work together in cooperation and negotiation.

The co-creation sessions were limited to guaranteeing the *continuation of advancing knowledge*. The pre-competitive trajectory is a good start to challenge the market partners to develop the new and innovative knowledge needed to execute the MWW program. The experiences gained and knowledge developed in the co-creation session could be a starting point for future knowledge development by the market partners, especially when the results of the co-creation sessions are made public. However, to market partners, knowledge continuity is a substantive contribution, as it is frequently expensive and tricky and in the long term, it is unclear whether it is necessary. Participants worried about the continuation of knowledge sharing. One interviewee stated that “it is not continuity of knowledge, but the continuity of sharing information that is important" (Interviewee 13). Some suggested that to keep knowledge sustainable over time, regular co-creation sessions should be organized by the client with the market partners. Participants can then continue to learn from each other and opportunities for creating a larger shared market can be explored. This maximizes the possibility of learning and ensures continuity, as one market partner advised “to organize this knowledge on disciplines instead of generating ideas in the future. Make it more concrete and applicable in real projects” (Interviewee 6).

4.4. Collaborative value-in-use

Apart from commercial and intellectual values, we found two collaborative values related to the co-creation sessions: increasing mutual trust and reassembling of partners in innovative networks. First, interviewees claimed *increasing mutual trust* between RWS and market partners during the execution of the co-creation sessions. A market partner stated that "at the start, we as contractors are looking for ‘what's in for us,’ but during the later sessions, my concerns disappeared more or less, and I was more open and was eager to give my own opinion" (Interviewee 8). From the first session, cooperation was put on the agenda. In subsequent sessions, personal interests and ambitions were discussed. As one of the

interviewees stated,

> "Market [partners] were somewhat laid back. At first, they were only interested in selling knowledge that they thought was safe to share. This was personalized, as some persons were more open than others. In the end, the atmosphere was more open because participants were better acquainted with each other" (Interviewee 3)

We observed the growth of mutual trust during the co-creation sessions in which various stakeholders worked together with a clear shared vision of interest. This is important, as earlier studies (e.g., Van Marrewijk et al., 2014) show that public and private actors find it difficult to experiment with innovative collaborative behavior encapsulated in power relations. Mutual trust between public clients and market partners was an important and sensitive topic in the Dutch construction sector after a parliamentary inquiry into construction industry malpractice in 2002, and both clients and market partners were forced to afford greater transparency and accountability (Sminia, 2011; Van Marrewijk et al., 2014). When these co-creation sessions are experienced by participants to contribute to improved collaboration, this is an important outcome.

Second, *reassembling partners in innovative networks* was an essential value-in-use of the co-creation sessions. Several interviewees expanded their relationship beyond the MWW program to other projects: "co-creation will lead to a sort of personalized friendship which is needed to start a further collaboration between client and market. The real collaboration starts after the co-creation" (Interviewee 4). The co-creation platform itself produces very little content, but according to interviewees, a large number of the participants become the leading producers of content. The core of the platform is to guide and promote user participation. According to one participant from a market partner, “in a way, it is efficient, having all parties together and talking and listening and in that way learning from each other” (Interviewee 6). In the interviews, it became clear that the mastery of professional knowledge is no longer

the only requirement for the market partners. Given the societal impact of infrastructure development projects (van den Ende and van Marrewijk, 2018), market partners must manage, coordinate and communicate with project stakeholders, transferring attention from production to management and integrating networks of stakeholders.

5. Discussion

This paper investigates what stakeholders do in co-creation sessions and how this contributes or limits the co-creation of value at the front end of the MWW program. The findings of our action research study show that by redefining the replacement of ship locks as a program instead of a collection of stand-alone projects, the client announced their ambition to connect the value of standardization and the intention to implement abstract notions of values on public-private collaboration to the program. In contrast to these ambitions, the market partners highly valued their freedom to design and implement innovations in the tender and realization phase of programs. The co-creation sessions brought together client, market partners, and knowledge partners to reflect upon these competing values-for-firm (Grönroos, 2011) and created an open space for discussing the market partners' and client's requirements regarding standardization. These discussions resulted in three sets of values-in-use (Goel and Yang, 2010): commercial, intellectual and collaborative values.

5.1 Front end co-creation of values-in-use

The findings of the study have shown that the co-creation sessions at the front end of the MWW program, as was suggested in the literature (Edkins et al., 2013; Thiry, 2002), provided two excellent opportunities for defining and creating values for the stakeholders. First, it was an opportunity for stakeholders to discuss their competing values-for-firm of standardization (RWS) and freedom (market partners). Competing values are no exception, but characteristic of public-private collaboration in the construction sector (Van Gestel et al., 2008), as the values of public and private partners can be different (Klijn and

Teisman, 2003). In the co-creation sessions, commercial and intellectual values-in-use were negotiated. Second, it was an opportunity to discuss the client's ambition of implementing abstract values of equality, trust, and openness in the program. In the co-creation sessions, the value-in-use of 'increasing mutual trust' and 'reassembling partners in innovative networks' emerged. The co-creation sessions at the front end thus helped mobilize the stakeholders to create the right values-in-use for executing the MWW program. These findings are in line with Winter and Szczepanek (2008; 96), who state that "the general task of a project or program is not to create value for customers but to mobilize customers to create their value from the project or program's various offerings."

The MWW program study shows that the concepts of value-for-firm and value-in-use, originally conceptualized in business and service literature (Goel and Yang, 2010; Gosselin and Bauwen, 2006), are useful for studying value creation in programs. Public and private stakeholders have different interests and viewpoints that must be integrated (Bowman and Ambrosini, 2000). As the concept of value is subjective (Chang et al., 2013), the co-creation of values-in-use can be understood as a way to negotiate values-for-firm in complex and uncertain project contexts, as has been requested by Martinsuo et al. (2018). The client announces the program's ambitions while market partners are attempting to maximize future value-in-use, for example, in market partners for qualifying for new work opportunities. Co-creation sessions customize values-for-firms at the front end of programs into value-in-use, for example, in defining six possible lock components for standardization. In this way, the concepts of value-for-firm and value-in-use help us understand the dynamic interaction between stakeholders at the front end of programs.

5.2 Contributions and limitations of co-creation

The MWW program study has found three contributions of co-creation sessions for creating value at the front end. First, co-creation sessions help client and market partners to communicate about and improve value propositions before they are bound by a formal contract. Central to these sessions is knowledge exchange, discussions of earlier experiences with similar projects, and open discussion between

stakeholders that can identify adaptive solutions and supplement and strengthen the value propositions addressed to programs. As has been suggested by others (Martinsuo and Killen, 2014), co-creation sessions play an essential role in governing the program and specifying the program value strategically. Notable here is that stakeholders, in our case, the market partners, client, and knowledge partners, acknowledge that no type of knowledge is superior to another (Edelenbos et al., 2011). This is not easy as equal power distribution among stakeholders is in contrast to the hierarchical, centralized infrastructure sector (Van De Meene and Brown, 2009). Second, co-creation sessions reduce the social distance of stakeholders at the front end of programs. All participants are given an equal opportunity to pitch their perspectives on programs and are invited to discuss what they expect from other participants. Third, and related to the two above-mentioned contributions, is that the co-creation sessions stimulate the emergence of a multidirectional interactive network of suppliers, engineer firms and knowledge partners. This network empowers stakeholders to interact and stimulates their equal and active participation, something that is not common in the infrastructure sector (van Marrewijk et al., 2008). Therefore, co-creation is very helpful for improving public-private partnerships in the infrastructure sector urgently there is an urgent need to answer the societal question of climate change, energy transition, and mobility (Sminia, 2011; van Marrewijk et al., 2008).

The MWW program study also shows two limitations of the front end use of co-creation. The first is related to the power imbalance between client and market partners. The initiating client can easily take over other voices with their dominant voice (Sminia, 2011), while it is entirely free to use the outcomes of the sessions. Second, while co-creation needs broad participation of all stakeholders, 30% of the stakeholders withdraw from the MWW program, as they did not want to give away their knowledge and design solutions for locks. Only those participants who saw future work opportunities were willing to share their knowledge. Third, co-creation sessions need the substantive contribution of partners to prevent a ‘ritual gathering.’ The MWW program client collected six possible lock components for standardization, but expected (much) more, as it hoped to create a catalog with components and bring it to the market.

5.3 Value creation in programs

The study shows the potential of programs over projects for creating values when a collection of stand-alone projects (locks) is redefined into a program (MWW). Programs are more efficient than separate projects placed on the strategic agenda of organizations and thus guarantee longitudinal managerial attention and direction (Martinsuo and Killen, 2014). Strong project-based cooperation between the client and their market partners, with often varying combinations of teams, stimulates stakeholder engagement and partnering. Partnering arrangements might serve as engagement platforms that enable the client and market partners to co-create value on infrastructure development programs (Jacobsson and Roth, 2014). Therefore, we argue that values are better secured within a program than in a collection of stand-alone projects.

Important for the creation of value in programs is the organization of the follow-up process. If it is not clear how the process is organized and what partners will do with the newly gained knowledge and relationships, the continuation of programs will be under pressure (Näsholm and Blomquist, 2015). In the MWW program, there was a lack of clear feedback on the continued program and follow-ups to keep the network alive. Co-creation sessions can be further developed into a kind of Community of Practice platform (Mutch, 2003) with an explicit agenda. In such a community, long-term relationships can be developed, while learning and discussion over new practices continue (Bjørkeng et al., 2009). This is in line with the business value provided by a Community of Practice (Hildreth and Kimble, 2004). Samset and Volden (2016) suggested that both client and market partners have not learned many lessons about how to work at the front end of projects. Previous research (Sminia, 2011; Van Marrewijk et al., 2014) has shown that current practices of collaboration between public and private parties in the infrastructure need improvement. A collaborative learning community seems to be an interesting opportunity to improve this collaboration and make learning a long-term goal.

6. Conclusion

Our research makes three contributions to value creation in the program literature. First, it adds an in-depth case study of stakeholders who co-create values-in-use at the front end of a program. This answers the call by Smyth et al. (2018), Martinsuo and Hoverfält (2018) and Martinsuo et al. (2018), as few empirical studies have been executed on value creation at the front end of programs. Understanding how co-creation is applied in programs increases our understanding of co-creation application in a multi-stakeholder setting apart from the production stage of construction projects (Eriksson et al., 2017). Second, we used literature on firm-user interaction for product value creation (Goel and Yang, 2010; Gosselin and Bauwen, 2006) to theorize the co-creation process in programs. The co-creation of values-in-use can be understood as a way to negotiate values-for-firm in complex and uncertain project contexts, as has been requested by Martinsuo et al. (2018). We have identified three sets of value-in-use co-produced by stakeholders at the front end. Thirdly, while other publications focus on value creation among a few stakeholders (Artto et al., 2016; Winter and Szczepanek, 2008), we show that co-creation sessions with a broad coalition of the client, market partners, and knowledge partners must be well organized to create values-in-use at the front end of programs.

The research has empirical implications for both client and market partners as value co-producers in infrastructure development programs. Although the concept of co-creation is not widely known in the infrastructure sector (Edkins et al., 2013; Thiry, 2002), it provides an opportunity for a balanced and enriched realization of value among stakeholders in programs. The front end of program interaction is essential to understand the client's value-for-firm. It is also an exciting intervention in current practices of collaboration between public and private partners in the infrastructure sector, as working in co-creation requires a mind shift by stakeholder employees (Jacobsson and Roth, 2014). Well-organized co-creation sessions can thus be helpful to implement sector strategies such as Market Vision. Therefore, a clear long-term platform is needed to make the interaction of stakeholders possible (Lee et al., 2012). Hopefully, this may stimulate further, more widespread use of co-creation in the infrastructure sector.

The study has several limitations and recommendations for future research. First, the single case study limits the application of the findings to other sectors and nations. Follow-up research could explore the co-creation of values-in-use in other infrastructure development programs or mega projects that have been managed as programs (Hu et al., 2016). Moreover, the choice of action research and the decision to interview only involved stakeholders may limit critical reflection (Yanow and Schwartz-Shea, 2015). From a methodological perspective, long-term value capturing should be investigated in the execution stages and post-project reviews. Since the on-going case of the MWW program focuses on the value creation and capture of co-creation sessions at the front end, future longitudinal research is needed to include more data in the execution stages and post-project reviews to extend our findings.

Appendix 1 interview protocol

Q1 Which co-creation sessions of the MWW program did you attend?

Q2 In which stakeholder do you work, and what is your role?

Q3 What is a program according to you?

Q4 Which opportunities do you foresee?

Q5 Were the participants equal in their roles during the co-creation sessions?

Q6 What is the exact contribution of co-creation to the process of value creation?

Q7 How does this process look like, how is it working?

Q8 What is needed next to perpetuate the knowledge gained?

Q9 What would you like to see in the future?

Q10 How will this result in better collaboration and what should the process look like?

Q12 Do you agree following statements?

(Strongly disagree, disagree, neutral, agree, and strongly agree)

- Co-creation sessions can provide an open place for collecting reusable information from the client and the market.
- Co-creation sessions can be seen as a program (MWW) start-up meeting.
- Co-creation sessions have produced an open setting, why, how.
- The sessions were necessary to open future opportunities.
- Co-creation is an efficient way to store and share newly gained knowledge between the client and the market.
- The market and client can complement each other's knowledge with different perspectives.
- Co-creation sessions can strengthen the shared understanding between the client and the market. How will this work out throughout co-creation?

- The results of the co-creation sessions published on the Bouwcampus and Tenderned website ensures the knowledge continuity. How are you going to use this newly gained knowledge? What is needed next for continuation?
- Co-creation sessions can foster knowledge sharing and promote mutual trust.
- Equal participant role setting can result in an increase in partnerships between public and private actors.
- Different participants can form a value network rather than a pipeline within the co-creation sessions.

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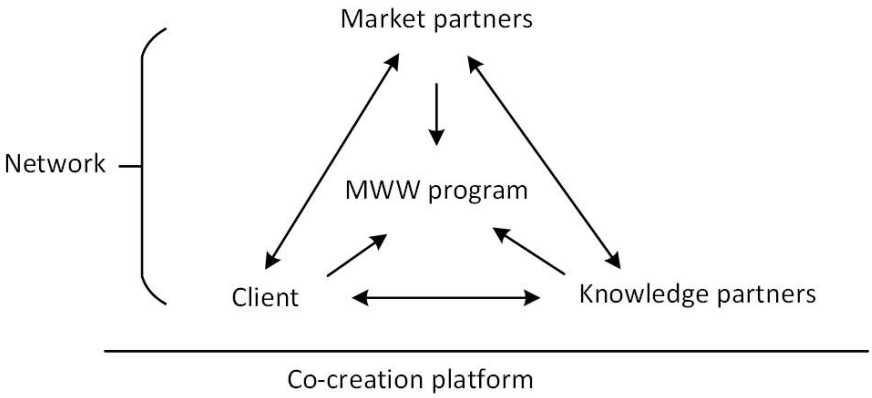


Figure 1. Co-creation sessions at the front end of the MWW program

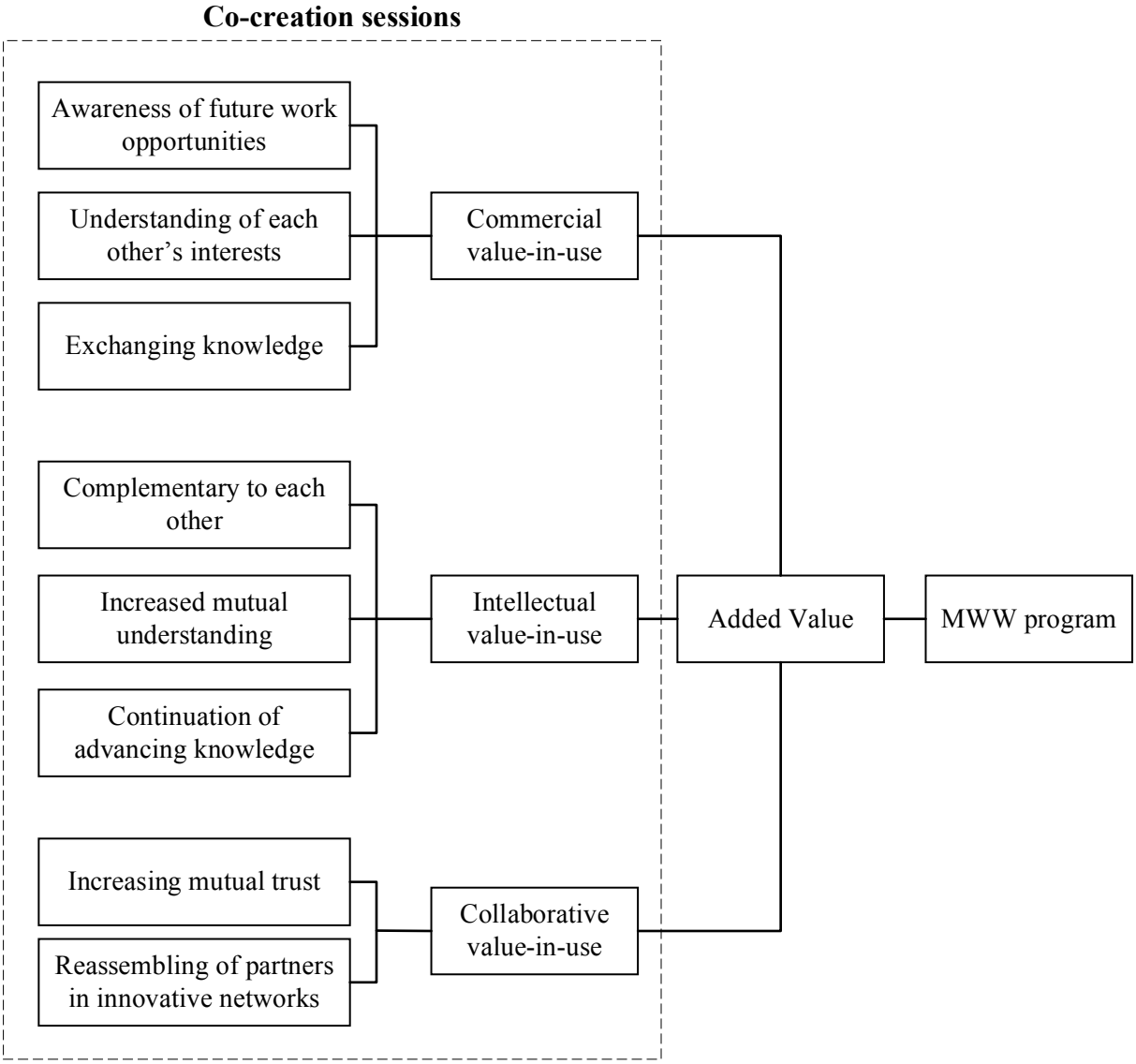


Figure 2 Three value-in-use categories and their sub-contents

Table 1: Profile of practitioners interviewed

No.	*Partner*	*Years of experience*	*# of sessions involved*	*Theme group leader*
1	Market	23	3	Yes
2	Market	10	4	Yes
3	Market	29	4	
4	Client	31	4	Yes
5	University	4	4	
6	Market	12	1	
7	Market	36	3	
8	Market	22	4	Yes
9	Client	23	3	
10	University	3	3	
11	University	2	1	
12	Client	41	4	Yes
13	Client	25	4	Yes
14	Client	5	1	

Table 2: Co-creation sessions for the MWW program

Session	*When*	*Aim*	*Description*
First session	April 21, 2016	Kick off by RWS and general discussion	RWS as the problem owner, starting the brainstorming on standardization of lock components, with the participants exploring possible themes, distilling the most important themes and jointly providing priorities in themes
Second session	June 29, 2016	Equal, open discussions around selected themes	Discussion over the philosophy of the program. Thirty percent of the attendees quit. Others determining themes from the first session, merging the themes into five themes, dividing themselves into five groups
Third session	October 5, 2016	Enrichment of themes	Reducing the social distance between stakeholders. Further elaborating themes, identifying relevant topics for consideration, introducing an extra theme and group
Sub-session	November 8, 2016	Agreeing on the ambition level of the results	Sharing and enriching the themes within the panel, and agreeing on the ambition level result
Sub-session	February 7, 2017	Agreeing on the ambition level of the results	Sharing and enriching the themes within the panel, and agreeing on the ambition level result
Fourth session	March 9, 2017	Common images and recommendations	Making public presentation, receiving feedback, and getting a commitment for six components that were found suitable for standardization