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Chapter 6

Improving the Agility of IT Service Networks

Agility in networks of IT service providers helps to swiftly adapt interdependent IT services to changing business needs. In this chapter a set of intervention actions is developed to improve the Agility of these IT service (provider) networks. The intervention actions are based on Agile literature, organizational change theory and empirically confirmed collaboration related factors in Agile IT service networks. The intervention actions are packaged into an Agile 5+1 intervention action framework. The result is an Agile 5+1 framework to improve the Agility in networks of IT service providers.

6.1   Introduction

In today's fast evolving economy business processes of large companies are continuously adapted to survive competition (Takeuchi & Nonaka, 1986). These business processes are to a large extent enabled by information technology. To keep the information technology (IT) operational, the IT staff needs to perform activities. These human activities, combined with the delivered IT is defined as IT services (Beck, 2010; van Bon et al., 2007). IT services are delivered by IT service providers (ISPs). Some ISPs deliver specialized IT services to a single company. Other ISPs deliver to a worldwide customer base (e.g. Google Drive). Many ISPs also deliver IT services to other ISPs. For instance, Microsoft delivering a cloud based platform to an internal ISP of a company for application hosting. As a result ISPs and IT services form networks (Vlietland et al., 2015; Vlietland & van Vliet, 2014c). The IT services in that interdependent (IT service) network are continuously updated, upgraded and renewed by the ISPs, driven by business requirements. The faster changes in an IT service network is achieved, the better the IT service network can follow the changing business environment. To achieve these changes collaboration between staff of different ISPs and different teams in the ISPs is required. That collaboration is clustered in IT software development processes (van Bon et al., 2007). These (workflow) processes flow within and throughout ISPs (J.R Galbraith, 1977).

In order to speed up IT software development of IT services, many internal ISPs transfer to Agile methods (VersionOne, 2013). Agile methods promote continuous change, rather than detailed planning upfront (Beedle et al., 2013). Achieving Agility in IT service networks involves many teams and ISPs, in which staff of the different teams and ISPs needs to interact and collaborate (Vlietland & van Vliet, 2015b). Such interaction and collaboration between staff has been extensively studied in software development contexts (Dorairaj et al., 2012; Paasivaara, Durasiewicz, & Lassenius, 2009; Sharp & Robinson, 2008; Sutherland et al., 2009). To support interaction and collaboration Soundararajan and Arthur (2009) argue that Agile software development practices need to be structured, for which they develop a soft-structured framework. Also other authors developed Agile software development frameworks to structure interaction and collaboration in large scaled Agile settings (Ambler, 2009; Larman & Vodde, 2013; Leffingwell, 2010; Qumer & Henderson-Sellers, 2008; Vlietland & van Vliet, 2015a). The (existing) Agile frameworks do not have an IT service network perspective and hardly cover non-software development processes, such as IT incident handling. For instance existing Agile frameworks are based on iterations, while IT incident handling is a continuous process that does not fit these iterations. A more generic Agile framework for IT service networks, that targets improvements and transcends software development is required. The objective of this research is to develop such framework: Agile 5+1. Agile 5+1 contains intervention actions to alleviate

the most common collaboration related issues in IT service networks. The generic nature of Agile 5+1 offers intervention action tailoring to the specific IT service network context. Agile 5+1 is aligned with other scaled Agile frameworks, such as the Scrum Chain Framework of Vlietland et al. (2015). The solid theoretical foundation of Agile 5+1 contributes to the need as mentioned by Freudenberg and Sharp (2010) and Dingsøyr and Moe (2013).

The remainder of this chapter is organized as follows. Section 6.2 discusses the related work. Section 6.3 develops the Agile 5+1 intervention actions. Section 6.4 develops the Agile 5+1 framework. Section 6.5 discusses Agile 5+1, including an operationalization example. Section 6.6 elaborates on the threats to validity. Section 6.7 concludes the study, deduces implications and suggests future research avenues.

6.2   Related work

Three categories of related work are covered. First an overview of scaled Agile frameworks is provided. Next, the essential elements of an IT process are identified, which are applied to Agile 5+1. The section closes with an overview of the collaboration related issues in Agile teams.

6.2.1   Overview of scaled Agile frameworks

In the last decade various scaled Agile framework have been developed. Leffingwell (2010), author of the SAFe framework, promote a three level framework, with the levels, (1) team, (2) program and (3) portfolio. Larman and Vodde (2013) use feature teams and liaison relations (J.R. Galbraith, 1971) with communities of practice (CoP) for exchanging knowledge and coordination between teams. They recently published their Large-Scale Scrum (LeSS) framework based these feature team and liaison principles (Larman & Vodde, 2015). Kniberg and Ivarsson (2012) also utilize the added value of liaison relations, by introducing chapters and guilds. Chapters are groups of people that share expertise. Guilds resemble more free-format special interest groups.

Ambler (2009) describes eight scaling factors to determine scaling complexity: (1) team size, (2) geographical distribution, (3) regulatory compliance, (4) domain complexity, (5) organizational distribution, (6) technical complexity, (7) organizational complexity and (8) enterprise discipline. These scaling factors can be applied to tailor the Disciplined Agile delivery (DAD) process decision framework for scaled Agile applications (Ambler & Lines, 2012). The DAD framework has similarities with the Rational Unified Process framework, both having inception, construction and transition phases (Ambler & Lines, 2012).

Sutherland (2001), the co-author of Scrum (Sutherland & Schwaber, 2013), publishes a 'Scrum at scale' framework via Scrum Inc. The 'Scrum at scale' framework has similarities (e.g. a similar lifecycle) with the Scrum framework (Sutherland & Schwaber, 2013). Scrum framework elements were also applied in the 'Enterprise Scrum' (Greening, 2010), for longer term direction with weekly standups and quarterly sprints. 'Agility path', a scaled Agile framework from the author of Scrum (Schwaber, 2011), aims transitioning the enterprise towards Agility (Schwaber, 2015).

The identified scaled Agile frameworks have several characteristics that do not fit the context of this study. The first misfit is that scaled Agile frameworks lack an IT service network perspective, while many ISPs and teams operate in a network constellations (Vlietland & van Vliet, 2014b, 2014c). Secondly, existing scaled Agile frameworks target software development practices, with fixed iterations. Meanwhile IT incident handling also requires structured Agile collaboration (Vlietland & van Vliet, 2014b, 2014c), while sprints do not fit such continuous process. Thirdly, most scaled Agile frameworks lack described intervention actions (Ambler, 2009; Leffingwell, 2010), while these intervention actions assist staff in achieving Agility (Vlietland et al., 2015). Lastly, Agile frameworks lack a theoretical foundation (Dingsøyr & Moe, 2013; Freudenberg & Sharp, 2010; Jalali & Wohlin, 2012).

6.2.2   Elements of IT processes in IT service networks

In this section the essential elements of an IT process are determined. These elements are targeted by the intervention actions (see section 6.3). Baltacioglu et al. (2007) defined a set of workflow processes for service chains. The defined processes flow through nodes in service networks. A set of processes that exist in the IT service industry is defined by the ISO standardized ITIL v3 framework (van Bon et al., 2007). In each of these IT processes activities are performed that requires collaboration between members in the IT service network.

A process is theorized by Ilgen et al. (2005): input is processed resulting in output. An IT process however has more 'elements'. Journalists describe and report about processes occurring in various forms and events. To describe these processes Journalists use six communication questions (6W), 'Why', 'Who', 'When', 'What', 'Where' and 'With' (Spencer-Thomas, 2012). These six questions have a sufficient abstract nature to define the essence of an IT process and determine the essential elements. Zachman (2002), the author of the generic enterprise architecture framework, uses 6W for segmenting his framework.

The element 'Who' refers to the entity that performs workflow activities. Roles and Teams are examples of 'Who' elements. Since staff has one or more roles and an ISP has teams, also staff members and ISPs fall under the 'Who' element.

The element 'When' refers to time; the time to execute workflow activities. Event and Lifecycle are examples of 'When' elements.

The element 'What' refers to the performed activities in an IT process and the result of the activities. Artifacts and deliverables also fall under the 'What' element.

The element 'With' refers to the means that support the workflow activities. IT4IT is an example of 'With' elements. IT4IT, or 'IT for IT' stands for tooling that automates IT processes, which is synonym for Automation in this chapter.

The element 'Why' refers to the rationale. In this study the 'Why' element refers to the objective of the IT process, which is already covered by the (Agile) priority setting process. The term 'Where' refers to geographical spread, which is a context specific operationalization element (see section 6.5). The elements 'Why' and 'Where' are therefore excluded as separate elements for this study.

6.2.3   Collaboration related factors

Vlietland and van Vliet (2015b) identified six collaboration related factors in chains of codependent Scrum teams that impact Agility: (1) backlog priority between teams, (2) coordination in the chain, (3) alignment between teams, (4) IT chain process automation, (5) information visibility in the chain and (6) delivery predictability. A subsequent study confirms that these factors impact the Agility of a chain of Scrum teams (Vlietland et al., 2015).

In this study these collaboration related issues are considered the most important issues in IT service networks for the following reasons: (1) The study of Vlietland et al. (2015) is executed in a chain of Scrum teams that characterizes a network with nodes and links. (2) Several authors conclude that supply chains and supply networks are similar in terms of collaboration (Cropper, 2008; Wilhelm, 2011). (3) IT incident handling tasks are based on prioritized backlogs (van Bon et al., 2007; Vlietland & van Vliet, 2014c) similar to Agile software development tasks (Sutherland & Schwaber, 2013). (4) Visibility has been also identified in the IT incident handling field and confirmed to be a factor for improved Agility in handling IT incidents (Vlietland & van Vliet, 2014b). For these collaboration related issues in IT service networks intervention actions are developed to enhance IT service network Agility (Vlietland et al., 2015).

6.3   Agile 5+1 intervention actions

To alleviate the collaboration related issues in the IT processes a set of intervention actions is developed. Each intervention action targets the combination of one of the four process elements (Who, When, What and With) and one of the six collaboration related issues (Coordination, Prioritization, Alignment, Visibility, Predictability and Automation). Since Automation is already covered by the 'With' element, no (separate) intervention actions are developed for the collaboration related factor 'Automation' (Vlietland & van Vliet, 2015b). What remains are '4 x 5' intervention actions. Each intervention action is theoretically grounded and discussed in the remainder of this section. The intervention actions are sorted in the order of the collaboration related issues, and labeled with '**[…]**'.

6.3.1   Coordination intervention actions

Coordination is defined by Van de Ven, Delbecq, and Koenig Jr (1976) as: "the process of linking together different parts of an organization to accomplish tasks collectively" (DeSanctis & Jackson, 1994). The organization (in this case the IT service network) needs to coordinate tasks that overarch ISPs and/or teams. Scheerer et al. (2014) compiles a conceptual framework with three types of coordination: (1) mechanistic coordination - coordination by formal plans and rules, (2) organic coordination - coordination by means of mutual adjustment and interactive feedback and (3) cognitive coordination - based on explicit and tacit knowledge sharing between actors, building a shared mental model (Mathieu et al., 2000).

Scheerer et al. (2014) argues that Agile environments require higher levels of organic and cognitive coordination, than mechanistic coordination. An higher level of organic and cognitive coordination better supports Agile organizations in adapting to a changing environment, than with mechanistic coordination. Thus, one intervention action in Agile IT service networks is:

> **[Pco]** *Embed organic and cognitive coordination practices between staff members of teams and ISPs.*

The capacity to reflect on past experience is one of the key principles for reflective practices and continuous learning (Holz & Melnik, 2004; Salo & Abrahamsson, 2005). Kolb (1984) abstracts the experiential learning process to the phases (1) concrete experience, (2) reflective observation, (3) abstract conceptualization and (4) active experimentation. A recurring, steady lifecycle with predictable reflection events supports such learning process. Upcoming planned events stimulate staff to reflect on their role and activities, which embeds learning. That argument is supported by Qumer and Henderson-Sellers (2008) arguing that knowledge engineering embedded in the

delivery process stimulates learning and improves Agility. Given the above the next intervention action is defined as:

[Pcn] Determine recurring coordination events fitting the delivery lifecycle.

Cataldo, Bass, Herbsleb, and Bass (2007) define schedules and tasks as artifacts for coordinating work between members in a software development environment. Begel et al. (2009) also identifies schedules and prioritized work items as artifact to coordinate work between teams, along with status of artifacts and context specific artifacts such as bugs and interfaces.

Creating, changing and updating coordination artifacts, requires coordination action (Ilgen et al., 2005). For instance a daily standup is a (coordination) action to coordinate work between team members in an Agile team. During the daily standup three predefined questions are answered to stimulate information sharing between members (Sutherland & Schwaber, 2013). The next intervention action is thus to define and deploy coordination artifacts and necessary actions:

[Pct] Define and deploy coordination artifacts and necessary actions between staff members of teams and ISPs.

IT service networks typically consists of multiple ISPs with many teams, implying that IT service network members are often physically dispersed (Paasivaara et al., 2012). To coordinate work in these dispersed settings IT4IT is applied, such as continuous planning (Fitzgerald & Stol, 2014). IT4IT enables staff members to instantly coordinate work items with their peers in other teams and ISPs. IT4IT also enables the storage of artifacts that are accessible, independent of location and time. IT4IT furthermore automates workflow processing, such as integration, testing and deployment (Beedle et al., 2013; Humble & Farley, 2010), which otherwise requires manual time consuming coordination activities (Humble, 2010; Vlietland & van Vliet, 2015b). The next intervention action is therefore defined as:

[Pch] Support coordination activities with automation.

6.3.2 Prioritization intervention actions

Priority issues in Agile settings have been identified by multiple researchers (Begel et al., 2009; Lehto & Rautiainen, 2009; Petersen & Wohlin, 2009; Vlietland & van Vliet, 2015b; Waardenburg & van Vliet, 2012). Also in network organizations priority is often mismatched and ambiguous between interdependent staff, resulting in delayed delivery (Vlietland & van Vliet, 2014a, 2015b). A characteristic of a network organization is confederation – a loose and flexible coalition (Mentzer et al., 2001). To coordinate priority setting in a network organization, a hub can be setup that guides

the priority setting process (Webster Jr, 1992). The hub has interdependent staff from teams and ISPs to perform the distributed priority setting process (Kniberg & Ivarsson, 2012). Priority setting processes are driven by decision making processes (Eisenhardt & Zbaracki, 1992; Vlietland & van Vliet, 2015b). For the priority decision process it should be clear (1) who is are the authorized decision makers over priority setting in the network, (2) who provides input about a decision and (3) how these roles are jointly held accountable (A. E. Brown & Grant, 2005; Eisenhardt & Zbaracki, 1992). Matching priority over teams and ISPs stimulates teams to simultaneously work on a common goal, resulting in more delivery predictability and more efficient execution (Lehto & Rautiainen, 2009; Vlietland & van Vliet, 2015b; Waardenburg & van Vliet, 2012). Matching priority also eases coordination of interdependent activities (Vlietland & van Vliet, 2015b). Thus, the next intervention action is defined as:

> **[Ppo]** *Assign authorized roles for priority decision making in the network.*

Distributed decision making is a bounded rational process (Eisenhardt & Zbaracki, 1992), which is caused by the cognitive limitations and motivational and emotional factors (Bazerman & Moore, 2009). These cognitive limitations result in a biased perception of reality and biased decision making (Eisenhardt & Zbaracki, 1992). Biased perception can be alleviated by merging the perceptions of different decision makers (Duffy, 1993), resulting in common ground for matched priority setting. Perceptions can be merged with recurring perception sharing and discussion events (Stout, Cannon-Bowers, Salas, & Milanovich, 1999). The need for such perception sharing and shared priority decision making events leads to the following intervention action:

> **[Ppn]** *Determine recurring perception merging and prioritization events that fit a lifecycle.*

The prioritizing and decision making process have activities that result in output (Ilgen et al., 2005). In case of prioritization activities the output is the prioritization result, an artifact containing a prioritized list with high level backlog items (Leffingwell, 2010). Also the decision making activities require artifacts, such as a list with objectives, that each includes the 'estimated cost of delay'; which can for instance be calculated with Weighted Shorted Job First (WSJF) (Leffingwell, 2010). The artifacts help focusing the prioritization process (Stout et al., 1999). For instance a prioritized list with ISP objectives that is shared between ISPs during the prioritization event assists the prioritization discussion. One intervention action is therefore to define and establish the artifacts, along with determining the critical prioritization activities. Hence, the next priority intervention actions is:

[Ppt] *Define the decision making and prioritization artifacts and necessary actions.*

Decision analysis and decision making tools assist the prioritization process (Bazerman & Moore, 2009; Eisenhardt & Zbaracki, 1992). These decision analysis tools include the support of decision making workflow. These tools also support the methods for identifying, representing, and assessing important aspects of a decision. The next intervention action is therefore:

[Pph] *Support the decision making and prioritization activities with automated decision analysis and decision making.*

6.3.3 Alignment intervention actions

Staff in the IT service network needs to collaborate to deliver interdependent IT services (Vlietland & van Vliet, 2014c). Such collaboration requires a shared mental model between staff (Jonker et al., 2011; Lim & Klein, 2006; Mathieu et al., 2000). Shared mental models are stimulated by grouping people together and stimulate communication and feedback (Stout et al., 1999). A shared mental model is described as cognitive coordination by Scheerer et al. (2014). Next to cognitive coordination, Scheerer et al. (2014) also identifies mechanistic coordination. Mechanistic coordination refers to coordination with formal rules and plans. These rules and plans can be used to develop the shared mental model (Stout et al., 1999), which eases the collaboration. The next intervention action is therefore defined as:

[Pmt] *Align the artifacts and workflow over the full IT service network.*

Workflow activities are executed by roles. Using similar roles over the IT service network helps collaboration in the network, as members easily recognizes the role of each other (Vlietland & van Vliet, 2014c). Aligned roles also assist in developing the shared mental model (Scheerer et al., 2014; Stout et al., 1999). Aligning the workflow over the service network therefore includes role alignment, leading to the next intervention action:

[Pmo] *Use similar roles over the full IT service network.*

A shared mental model improves collaboration between staff in a network (Lim & Klein, 2006). Such shared understanding is achieved by information sharing between staff (Vlietland & van Vliet, 2014c). That information sharing is empowered by close collaboration (Scheerer et al., 2014). In many cases staff however cannot work closely together since staff is part of different teams or even different ISPs. These teams and ISPs are often located at different locations, impeding the development of organic

alignment (Scheerer et al., 2014). Given the impeded organic alignment, mechanistic coordination is required to share information and build a shared understanding (Scheerer et al., 2014; Stout et al., 1999). Such mechanistic coordination is achieved by setting up events with predefined members (roles). The information that these members share during the events builds the shared mental model (Jonker et al., 2011; Stout et al., 1999). The next alignment intervention action is therefore:

[Pmn] *Plan and organize alignment events over the full IT service network.*

Multiple ISPs and teams take part in IT service networks. These ISPs and teams are typically distributed and requires IT4IT to collaborate effectively (Vlietland & van Vliet, 2015b). Such automation brings the opportunity of aligning the automated workflow over the IT service network. For instance by having workflow states that are identical over the full IT service network. Such predefined alignment helps developing the shared mental model (Jonker et al., 2011; Stout et al., 1999), enabling members to quickly understand the shared workflow information (Vlietland & van Vliet, 2014c). Our last alignment intervention action is therefore:

[Pmh] *Align the automated workflow processes in the IT service network.*

6.3.4   Visibility intervention actions

Several researchers concluded that visibility of information improves supply network performance (Bartlett et al., 2007; Vlietland & van Vliet, 2014b). Vlietland and van Vliet (2015b) studied IT service networks confirming information visibility as a factor to improve IT service network Agility. The information that needs to be shared in IT service networks was studied by Vlietland and van Vliet (2014c). They identified three networks; the human, the contractual and the technical network (Vlietland & van Vliet, 2014c). In the human network they identified the following information categories that need to be shared: (1) the network of human resources, (2) contact details of the resources, (3) changes in resources, (4) the process (human activities) and (5) the roles of the resources. Based on these studies the next intervention action is defined as:

[Pvo] *Share information about the human roles in the full IT service network.*

Vlietland and van Vliet (2014c) conclude that information about the human process needs to be shared in IT service networks. In human (workflow) processing input is transformed to output (Ilgen et al., 2005). In virtual environments workflow processes result in virtual artifacts. These artifacts are stored as information in technological stores. Vlietland and van Vliet (2013) research the impact of information visibility on the performance of workflow processes that run through multiple collaborating teams. In a related research Vlietland and van Vliet (2014c) identify the information that

needs to be visible. Many of the identified items refer to artifacts, such as recorded IT incidents, technical designs and service level agreements. That need for visibility of such artifacts leads to the next intervention action:

[Pvt] *Share information about the artifacts throughout the full IT service network.*

In product supply networks information visibility is enabled by information technology, for instance for status and position tracking of items (Zhang et al., 2011). Items in the software engineering that are tracked are tasks on a backlog (Sutherland & Schwaber, 2013). The information of these tasks (e.g. status, content, deadline) can be made visible with Continuous planning software (Fitzgerald & Stol, 2014). Also in the IT operations field information visibility is achieved with information technology (Jäntti, 2012a). The next intervention action is therefore:

[Pvh] *Support information visibility in the IT service network with information technology.*

Empirical research in the supply chains shows that information sharing helps improving performance (Rashed et al., 2010). Information sharing can be stimulated with (sharing) events. In the Agile software development field Scrum of Scrums and daily standups are examples of events that stimulate information sharing between members (Paasivaara et al., 2012). These information sharing events help building a mutual understanding, such as the achieved results, the status of activities and the impediments (Sutherland & Schwaber, 2013). In case information about these events are visible in the IT service network, staff can subscribe to these events, and contribute in information sharing. Since these events help in sharing knowledge, the last visibility intervention action is:

[Pvn] *Share information about the events throughout the full IT service network.*

6.3.5   Predictability intervention actions

Interdependency between IT services implies that a disruption in one IT service disrupts interdependent IT services (Vlietland & van Vliet, 2013). The risk of disruptions increases with the number of interdependencies (Vlietland et al., 2015). For instance in case of a network with 10 interdependent IT services, each delivering with 90% predictability, results in 35% (0.9^{10}) overall (IT service) predictability. One way to increase predictability is reducing the number of interdependencies, leading to the first predictability intervention action:

[Put] Remove interdependencies between the IT services in the IT service network.

The second way is removing the causes of unpredictability in each of the interdependent IT services. Removing the unpredictability requires the responsible members to alleviate unpredictability. Agile teams have self-organizing, group-learning and instability characteristics (Takeuchi & Nonaka, 1986). These characteristics allows Agile teams in making delivering on commitment a team effort (Schwaber, 2004). One of the intervention actions is therefore to allocate clear responsibility for predictable delivery in the team:

[Puo] Allocate clear responsibility in the team to deliver with high predictability.

Agile teams need to have information about the target and realized delivery predictability (Vlietland & van Vliet, 2013). Comparing the realized predictability with the predictability goal, initiates (adapted) action to reach a more predictable IT service (Andrei, 2006; Wiener, 1965). Since information technology enables the workflow process (Fitzgerald & Stol, 2014), the predictability of each IT service (and predictability improvement) can be measured with information technology (Vlietland & van Vliet, 2014b). The next predictability intervention action is therefore:

[Puh] Visualize the predictability of each team in the IT service network with automation.

A workflow process is executed in a timeline with intermediate delivery events and milestones (Mahnic & Zabkar, 2012; Vlietland & van Vliet, 2014b). The intermediate events and milestones result in intermediate artifacts. Predictability of artifact delivery during these intermediate events is an indicator for predictable IT service delivery (Shalloway, Beaver, & Trott, 2009). One of the intervention actions is therefore to monitor the delivery predictability of the intermediate artifacts:

[Pun] Monitor the delivery predictability of the artifacts during the intermediate events.

6.4   Agile 5+1 framework

In this section the intervention actions are packaged into the Agile 5+1 (intervention action) framework. The Agile 5+1 framework has two dimensions. One dimension is based on the four IT process elements (Who, When, What and With). The second dimension of the framework is based on the collaboration related issues (Vlietland & van Vliet, 2015b). The framework has '5' collaboration related factors. '+1' refers to the 'Automation' collaboration factor, that is indirectly covered by the 'With' element

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(see start section 6.3). The Agile 5+1 framework is shown by Table 25. Each cell in the table contains one intervention action for enhancing IT service network Agility.

Table 25, Intervention action framework for improving IT service network Agility

↓Factor	Who	When	What	With
Coordination	**[Pco]** Embed organic and cognitive coordination practices between staff members of teams and ISPs.	**[Pcn]** Determine recurring coordination events fitting the delivery lifecycle.	**[Pct]** Define and deploy coordination artifacts and necessary actions between staff members of teams and ISPs.	**[Pch]** Support coordination activities with automation.
Prioritization	**[Ppo]** Assign authorized roles for priority decision making in the network.	**[Ppn]** Determine recurring perception merging and prioritization events that fit a lifecycle.	**[Ppt]** Define the decision making and prioritization artifacts and necessary actions.	**[Pph]** Support the decision making and prioritization activities with automated decision analysis and decision making.
Alignment	**[Pmo]** Use the same roles over the full IT service network.	**[Pmn]** Plan and organize alignment events over the full IT service network.	**[Pmt]** Align the artifacts and workflow over the full IT service network.	**[Pmh]** Align the automated workflow processes in the IT service network.
Visibility	**[Pvo]** Share information about the human roles in the full IT service network.	**[Pvn]** Share information about the events throughout the full IT service network.	**[Pvt]** Share information about the artifacts throughout the full IT service network.	**[Pvh]** Support information visibility in the IT service network with information technology.
Predictability	**[Puo]** Allocate clear responsibility that enhances delivery predictability in the team.	**[Pun]** Monitor the delivery predictability of the artifacts during the intermediate events.	**[Put]** Remove interdependencies between the IT services in the IT service network.	**[Puh]** Visualize the predictability of each team in the IT service network with automation.

The Agile 5+1 framework is iconized by the Agile 5+1 model shown in Figure 26. The model illustrates the human members (blue) in the IT service network. The 'orange buttons' illustrate the 5 collaboration related issues. Each button contains four intervention actions to alleviate one collaboration related issue. Automation is illustrated as a surrounding button (+1), with the intervention actions covered by the 'With' element.
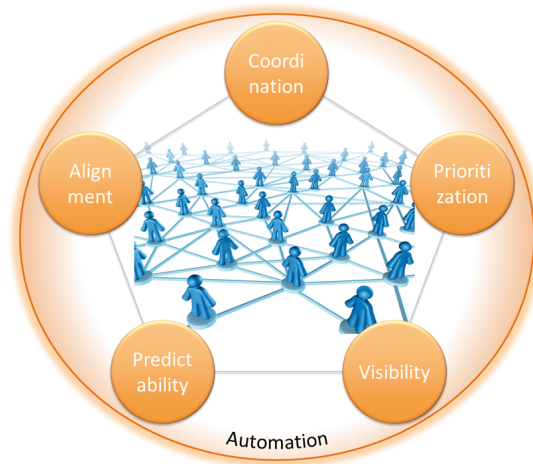
Figure 26, Icon of Agile 5+1

6.5   Discussion

Agile 5+1 targets the full lifecycle in Agile IT service networks; from initiating new ideas to IT incident handling. The intervention actions in the framework need to be tailored to a workflow process in an IT service network. An example of such tailoring is presented by Vlietland et al. (2015). They operationalize Agile 5+1 for a set of codependent Scrum teams, leading to the Scrum Value (chain) Framework. For instance the intervention action Agile 5+1: "*[Pct] Define and deploy coordination artifacts and necessary actions between staff members of teams and ISPs.*", is operationalized by the artifacts *feature backlog* and *feature description* in the Scrum Value (chain) Framework (Vlietland et al., 2015). A second example that fits Agile 5+1 are the visibility based intervention actions in an IT service network in the IT operations field, performed by Vlietland and van Vliet (2014b).

The remainder of this section discusses an IT incident handling scenario in an IT service network, with multiple ISPs delivering interdependent IT services. The scenario describes the IT service network after having multiple Agile 5+1 intervention actions operationalized. In the scenario we refer back to the intervention actions, with the bracketed labels '[…]'.

The scenario starts with a critical IT failure in one of the ISPs, resulting in an avalanche effect of IT failures in the interdependent IT services. The IT failures are automatically detected [Pvh], recorded and placed on the applicable backlogs. Prioritization of the IT failure on the backlogs is supported with decision analysis tooling [Pbh], and manually adjusted by the authorized decision makers [Ppo]. The incident handling work items, which links to the recorded IT failure, are placed on the backlogs with highest priority.

The work items and workflow is visible in all involved teams [Pvn][Pvt], enabled with IT4IT [Pvh]. The teams also have visibility over the involved IT services and underlying IT components [Pvt]. The applicable teams are notified about the new high priority backlog items and instantly start working on the IT failure. The IT4IT [Pvh][Pch], supports active online discussion and root-cause analysis [Pco]. The roles are aligned over the full network [Pmo], minimizing the need for information sharing about the 'way of working', which avoids misunderstanding. The roles (members) are easily accessible via the IT4IT [Pmh][Pvo]. Once the root-cause is identified the failing IT service is fixed and brought back online, which is notified by the other teams. The work items are closed in the IT4IT and the IT failure is resolved.

6.6   Threats to validity

The (inductive) Agile 5+1 framework has been largely based on the six collaboration related issues, which were identified in a multiple case study in the software development environment (Vlietland & van Vliet, 2015b). Only visibility as Agile improvement factor was also identified in the IT operation environment (Vlietland, 2011; Vlietland & van Vliet, 2013, 2014c). Yet, whether the six issues exist in other IT service network environments remains hypothetical.

Furthermore, the impact of the collaboration related factors have been tested in a single case study with codependent Scrum teams in the software development area (Vlietland et al., 2015). That case study did however not test the effect of the individual intervention actions (Vlietland & van Vliet, 2015b). Only visibility as Agile improvement factor was also confirmed in an improvement case study in the IT operation environment (Vlietland & van Vliet, 2014b).

Agile 5+1 furthermore has an abstract nature. The intervention actions need to be tailored to the specific context as discussed in the previous section. Such tailoring process involves many organizational contextual factors. These factors need to be identified and linked towards applicable organizational design theory (Daft, 2009; J.R Galbraith, 1977), while taking the Agile principles and objectives into account.

6.7   Conclusion

The objective was to develop a set of intervention actions that improves the Agility of IT service networks. To that end results of existing literature were abstracted, including the identified collaboration issues in IT service networks. That literature was used to develop the set of intervention actions, which was subsequently packaged in an Agile 5+1 (intervention action) framework with two dimensions. The intervention actions aim improving Agility in IT service networks.

The Scrum Value (chain) Framework (Vlietland et al., 2015) and the visibility interventions (Vlietland & van Vliet, 2014b) can be seen as incarnations of Agile 5+1. The Scrum Value (chain) Framework incarnation deploys (tailored) intervention actions that target a codependent set of Scrum teams. Even though the intervention actions of the Scrum Value (chain) Framework have been developed prior to the intervention actions in Agile 5+1, both target the same issues. Also the visibility intervention actions for improving IT incident handling performance (Vlietland & van Vliet, 2014b) fit Agile 5+1.

A limitation is the limited number of IT service networks in which the collaboration related issues have been identified. One future research opportunity is therefore to perform confirmatory case studies in various IT service network settings, to validate the existence of the collaboration related issues.

Another limitation is the hypothetical nature of Agile 5+1. Even though Agile 5+1 have been incarnated with the Scrum Chain Framework and with the visibility interventions in IT operation, Agile 5+1 itself has not been tested. A future research avenue is therefore to test Agile 5+1 and the individual intervention actions in various IT service networks. These results might enhance Agile 5+1 with a sequenced set of intervention actions, depending on the contextual conditions.

A third limitation is the abstract nature of Agile 5+1. A future research opportunity is therefore to develop tailoring guidelines based on applicable organizational design theory (Daft, 2009; J.R Galbraith, 1977).

A fourth limitation of Agile 5+1 is the improvement focus on process, roles and deliverables. These 'hard' aspects, of operationalizing Agile 5+1 typically require a shift in mindset and behavior. These investments can be significant depending on the existing organizational culture. A future research opportunity might therefore be to expand Agile 5+1 with guidelines for changing mindset and behavioral aspects.

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