Impediment Impact Diagrams

Understanding the impact of impediments in agile teams and organizations

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***Abstract*— Achieving a smooth flow of work through the system is a goal for many teams and organizations that embrace agile and lean approaches. However, the flow of work faces many impediments as it flows through teams and organizations. Agile and lean approaches can reveal impediments that impact teams and organizations. Often at the start of their agile transition, but also frequently after the initial transition, teams and organizations can find themselves with a significant quantity of impediments that demand attention. With limited time and capacity, they need techniques to help them understand the impediments and make decisions about where to invest their time. This paper introduces a new technique called Impediment Impact Diagrams that helps people to understand which impediments to address, and who needs to be involved in addressing them. The technique can also be used to understand other attributes of impediments such as the relative cost of removing the impediment, or the relative duration it is likely to take to remove the impediments. The Impediment Impact Diagram can be used on its own or as part of an Impediment Removal Process. Drawing from original research on impediment removal, this paper includes detailed steps to use the technique, presents several examples of Impediment Impact Diagrams from multiple teams and organizations, and describes their experiences with the technique.**

Keywords—impediment; flow; waste; agile; lean; impediment impact diagram; decision making; impediment categories; capacity; action research; adaptive action; human systems dynamics; stakeholder; visualization

I. Introduction

This paper introduces a new technique called Impediment Impact Diagrams. The technique is part of a wider research program on impediment removal in agile teams and organizations. Another publication describes in detail the concept of impediments in agile teams and organizations, and how impediments impact the flow of work [1]. This paper builds on that research, to help teams and organizations understand specifically how to understand the backlog of impediments that accumulate, and to make decisions regarding how to tackle those impediments. Note that this paper is not about the impediments themselves, and while there are examples of actual impediments, these are used for illustration of the Impediment Impact Diagram technique. The purpose of the paper therefore is not to analyze the impediments; the purpose of the paper is to present and analyze the Impediment Impact Diagram technique and its role in helping teams and organizations to understand the impediments from a given set of perspectives and make decisions about where to invest their capacity in removing the impediments.

A. Impediments to Flow in Software Development

Frameworks such as Scrum place an explicit focus on removing impediments, though without defining what impediments are [2]. There is little guidance in the agile software literature on learning to see, understand or manage impediments. Even after they have learned to identify impediments to flow, this research has found that people in teams and organizations have difficulty understanding how to manage impediments, how to measure and quantify their impact, and how to make trade-offs about which ones to tackle first. Another paper based on this research describes a framework for helping teams and organizations to see and categorise impediments [1]. In that paper the authors define an impediment to flow as "*anything that obstructs the smooth flow of work through the system and/or interferes with the system achieving its goals*". That paper also presents a categorisation of impediments that is summarised in TABLE I.

TABLE I. Impediment Categories

Category	*Definition*
Extra Features	Extra Features are those features that are added without either a proven need or valid hypothesis.
Delays	A delay is a situation in which something happens later than it should, and implies a holding back, usually by interference, from completion or arrival.
Handovers	Occur whenever incomplete work must be handed over from one person or group to another.
Failure Demand	Failure demand refers to the demand placed on systems (including teams and organizations) and is "demand caused by a failure to do something or do something right for the customer"
Work In Progress	Analogous to inventory in software development. Work that is not yet complete, and, therefore, does not yet provide value to the business or customer.
Context Switching	Context switching occurs when people or teams divide their attention between more than one activity at a time
Unnecessary Motion	Unnecessary motion is any movement of people, work or knowledge that is avoidable, that impedes the smooth flow of work, or that creates additional inefficiencies
Extra Processes	Extra processes generate extra work that consumes time and effort without adding value
Unmet Human Potential	The waste of not using or fostering people's skills and abilities to their full potential

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B. *Understanding Impediments in Human Systems*

Gerald Weinberg describes the Satir Interaction Model and how our internal human processes have four parts: intake, meaning, significance, and response [3]. These are shown in Fig. 1.

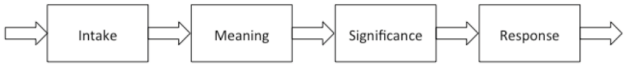

Fig. 1. The Satir Interaction Model.

Relating the Satir Interaction Model to the problem of impediments to flow in teams and organizations: intake relates to identifying problems, meaning relates to understanding more about the impediments, and response relates to how we consider countermeasures to remove the impediment. The third step, significance, is where we give priority to the impediments. Without that step, we risk becoming overwhelmed with a flood of data. The Impediment Impact Diagram is a tool that helps teams and organizations attach significance to the impediments they are seeing. This is particularly useful in those cases where there is a flood of impediments and we want to make decisions.

When trying to understand the impact of impediments in a team or organization, it is useful to take a systems perspective. Dooley notes that "*the prevailing paradigm of a given era's management theories has historically mimicked the prevailing paradigm of that era's scientific theories*" [4]. The complexity sciences have emerged as one of the prevailing paradigms for modern management thinking in general [5, 6]. Stacey has shown that "*all organisations are complex adaptive systems in which groups and individuals are the agents*" [7]. Agile teams and organizations, therefore, are better understood as complex adaptive systems (CAS) that are self-organizing and have emergent properties. Human Systems Dynamics (HSD) defines a CAS as a "*collection of individual agents who have the freedom to act in unpredictable ways, and whose actions are interconnected such that they produce system-wide patterns*" [8, 9]. Impediments influence the system-wide patterns that emerge in a complex adaptive human system [1]. The diagram in Fig. 2 shows that as the agents (people, teams, organizations) in a system interact, patterns emerge in the system. These patterns are sometimes perceived as "culture", or "the way we work" [9]. As work flows through the system, impediments influence the patterns that emerge. These impediments cause a tension in the system, which in turn, influences the behavior of the agents. So, as impediments are discovered, they create a tension that prompts the people to take action. Impediment Impact Diagrams provide a way to focus the agents on the significant impediments, and to understand which ones are within their span of control to resolve.

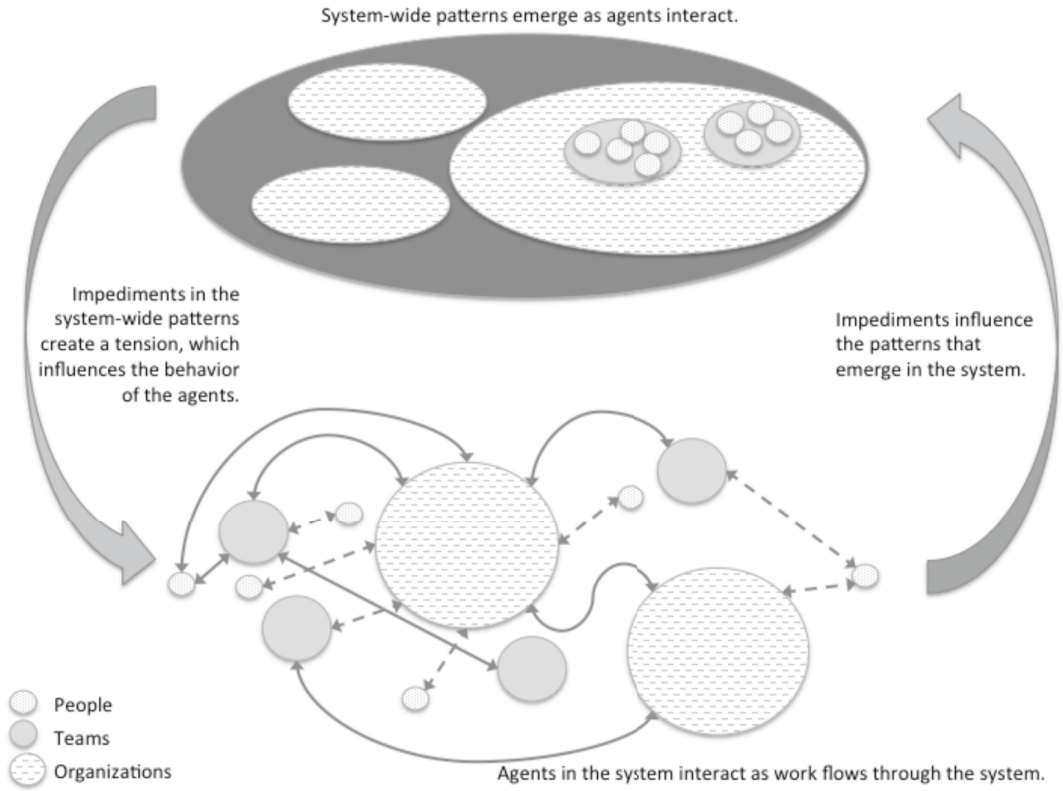

Fig. 2. Impediments influence the system-wide patterns that emerge in a CAS [1].

Adaptive Action is a process that helps teams and organizations to navigate complexity and uncertainty in a complex human system [9]. The core of Adaptive Action is based around three questions: "*What?"*, "*So What?"* and "*Now What?"*. *Intake* in the Satir Change Model relates to the "*What?*". *Meaning* and *Significance* relate to the "*So What?*". *Response* relates to the "*Now What?*". The relationship between the Satir Interaction Model and the Adaptive Action model is shown in Fig. 3.

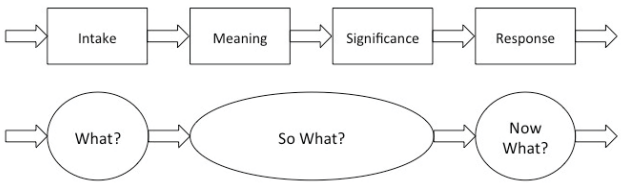

Fig. 3. Comparing the Satir Interaction Model and the Adaptive Action Cycle. Impediment Impact Diagrams help with understanding the *Meaning* and *Significance* stages of the Satir model, and the "*So What?*" step of the Adaptive Action cycle.

The Impediment Impact Diagram is a tool that helps take teams and organizations from "What?" (What are the impediments to flow?) to "So What?" (So, what is the significance of the impediments? What are the patterns we see showing up in the system?).

C. *The Impact of Impediments on Team Capacity*

There are some impediments that a Scrum Master or manager might remove on behalf of a team. There are others for which it will make more sense for one or more people on the team to remove themselves. For those impediments there is a direct reduction on the teams capacity. The term *capacity* is defined as the available capacity of the team or organization to get work done. For example, a team of seven people using Scrum and employing two-week Sprints will have an ideal capacity of 7 x 40 x 2 hours, or 560 hours. However, many teams apply a load factor to account for the fact that their ideal capacity gets consumed by other activities such as meetings or responding to email. If the team applies a load factor of 0.6 then the actual capacity would be 336 hours. Some teams prefer to express their capacity in terms of user story points, so this team might instead state that they have a capacity of 60 points available in each Sprint. In either case, the capacity acts as a limit on how much work the team can get done in a Sprint. Removing impediments eats in to that capacity. The tradeoff is that removing the impediment is a short term reduction in capacity that will have benefits to the overall ability of the team to get work done one the impediment is removed.

II. Related Work

This section describes some concepts that share the same roots as the technique used to create the Impediment Impact Diagram, or that are complimentary related tools.

1) *Force-Field Analysis*

Force Field Analysis is a way of understanding the forces for and against a proposed change [10, 11] Lewin postulates that a change can only be successful if the forces for the change are stronger than those against the change. A force field analysis gives teams and organizations an opportunity to strengthen the forces for a change, and mitigate the forces against the change. As it relates to impediments, force field analysis is a complimentary tool can be used to understand the forces for and against the changes required to remove an impediment. Force Field Analysis can help understand the impact of the different forces that affect the change. In addition, the forces against the change can themselves be considered impediments.

2) *Affinity Grouping*

The technique described in this paper employs elements of affinity grouping in a number of ways. First, the columns created to demarcate stakeholder groups can be viewed as affinity groups. Second, impediments within each area can be organized into affinity groups, which we often do if there are large quantities of impediments.

3) *Silent Grouping*

Silent Grouping is a means of quickly generating consensus and finding points of disagreement in a group without speaking [12]. Jean Tabaka also describes a technique called Silent Grouping, as part of a set of techniques used to help teams process large amounts of information in retrospectives [13]. The application of silent Grouping in that paper is to teams sizing user stories. The steps in the technique described in Section IV.D are drawn from those used in Silent Grouping [12].

4) *Landscape Diagram*

The Landscape Diagram created by Ralph Stacey is a useful tool for understanding and relating the main drivers for change in a human system [14]. In the context of self-organizing human systems, the Landscape Diagram is one of the most effective tools for forming the "So What?" stage of an Adaptive Action Cycle (see section I.B above) and can be used to "*distinguish the unstable and unpredictable dynamics from those that are stable and relatively predictable*" [9].

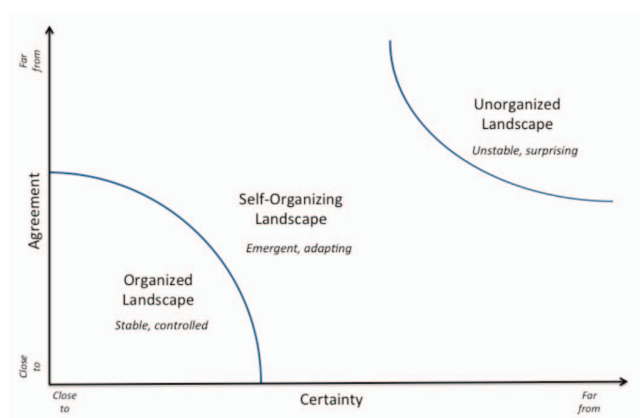

Fig. 4. Landscape Diagrams help understand drivers for change

Landscape Diagrams and Impediments Impact Diagrams are complimentary tools. We often use a Landscape Diagram to understand where impediments sit in terms of stability in human systems. This is the subject of further research in this area, related to this paper.

5) Stakeholder Theory

When it comes to supporting a team in removing impediments, support from different stakeholders will be required. Stakeholder theory provides tools for identifying and managing stakeholders. Freeman developed a two-tier model that distinguishes between primary and secondary stakeholders [15]. The diagram in Fig. 5 shows a typical stakeholder map using Freeman's two-tier stakeholder model.

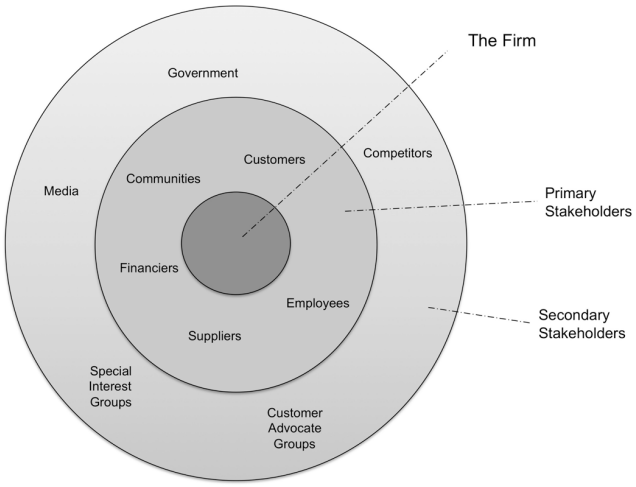

Fig. 5. Basic 2-tier stakeholder model

This map shows the firm at the center, and shows the primary and secondary stakeholder groups in the firm. Some stakeholders will naturally have a higher degree of relative importance or urgency. Salience is the principle of defining who and what really counts to an organization. This is key to understanding the stakeholders that organizations and teams should pay most attention to. Mitchell, Agle and Wood define a model for classifying stakeholders based on attributes of power, legitimacy and urgency that helps managers understand and quantify the degree of salience a stakeholder possesses [16]. Salience has a dynamic aspect, and those stakeholders that a team should pay most attention to can change over time.

The horizontal axis in impediment diagrams is labeled "influence". It is generally used to understand the impediments that need involvement from other stakeholders to resolve or remove. The axis is segmented into different areas. At its most basic, the areas can be "inside the team" and "outside the team", though it often helps to be more specific and name the stakeholder groups. Section VII below includes some examples of this, where teams found it useful to identify specific stakeholder groups that are affected by impediments or are instrumental in removing the impediments.

To compliment the Impediment Impact Diagram, we often draw a stakeholder map like this, but with the team or group at the center. Identifying primary and secondary stakeholders helps teams and groups to understand who it may be necessary to influence or gain help from in removing impediments. This is particularly relevant for those impediments that the team cannot remove themselves.

III. Research Approach

For the purposes of this paper the author has selected a number of representative groups from the wider research. The data in TABLE II. below presents a summary of the groups represented in this paper. The groups represented as A1, A2.1, A2.2 and A3 are all part of the same multinational company. The group represented as B is part of a different multinational company. Groups A2.1 and A2.2 work in the same business unit, and contribute to the development of the same set of products. There are three distinct business units represented from company A; groups A1 and A3 work in different business units from each other, and from the business unit in which groups A2.1 and A2.2 work.

TABLE II. Groups Represented in This Case Study

Case	Group Characteristics			
	Type	***Location***	***# People***	***Purpose of Group***
A1	Program Managers	USA	12	Director and multiple program managers who support the work of an organization of more than 2000 engineers in USA, Europe, China.
A2.1	Scrum Team	Europe 1	8	Develop features for real-time voice, video and messaging applications.
A2.2	Group of Scrum Teams	Europe 1	26	Develop features for real-time voice, video and messaging applications.
A3	Agile Transition Team	Europe 2	15	Directors, managers, and other people with some responsibility for the organization's agile transition.
B	Leadership Team	Europe 3	18	Senior managers and team leaders who represent all functions of the organization responsible for delivering products and services.

For each of these, the activity described in was run as a part of a retrospective, an impediment identification workshop, or a wider action workshop. In all cases it was one of several activities used in the session. The forum for each of the groups is described in TABLE III.

TABLE III. CONTEXT FOR RUNNING THE ACTIVITY

Group	*Context*
A1	Half-day workshop on identifying impediments and desired changes in the wider organization.
A2.1	Sprint retrospective.
A2.2	End-of-program retrospective.
A3	Dedicated impediment identification workshop.
B	Full-day workshop on identifying and managing waste.

A. Research Methodology

The research described in this paper uses Action Research. There are several reason that Action Research is appropriate for this research [17]:

- The people "*affected by or having an effect on an issue should be involved in the process of inquiry*".
- The researcher is a "*research facilitator*" who coordinates or facilitates inquiry.
- All participants in the research process "*engage in deliberate processes of inquiry or investigation with the intent of extending their understanding of a situation or problem*".
- The research is with industry practitioners in their actual work setting. There is a need to achieve results. As Stringer notes, "*if an action research project does not* make a difference*, in a specific way, for practitioners or their clients, then it has failed to achieve its objective*" [17]. This research has at least two specific objectives to make a difference. First, for the participants, a primary objective is to engage in a process of inquiry that identifies impediments to the flow of work through their system, and by extension, reveals underlying patterns in their systems. Second, for the researcher, a primary objective is further develop a holistic understanding of the impediments that affect the flow of work through teams and organizations, and, by extension, to understand patterns across multiple systems.

B. A Participation-Based Approach to Inquiry

Where other research methods treat people, teams and organizations as "subjects" of research, Action Research engages stakeholders as full participants in the research [17]. Action Research provides a way for the people affected by a problem to play a part in solving the problem. In other words, Action Research provides a model for enabling local action-based approaches to inquiry where a goal is to apply small-scale hypotheses to specific problems in specific contexts[18]. This approach very complimentary with agile and lean approaches including Lean Startup's build-measure-learn cycle, agile's philosophy of small-scale experiments, the Deming/Shewart Plan-Do-Study-Act cycle, the Sprints in Scrum, or the iterations of XP.

Stringer notes that "*a fundamental premise of participatory action research is that it commences with an interest in the problems of a group, a community or an organization*" [17]. The purpose of participatory action research, according to Stringer, is to "*assist people to extend their understanding of their situation and to resolve significant issues or problems that confront them*". For each of the teams or groups referenced in this paper, the research began with an interest in the problems of the team, group or organization. Specifically, the problems that prevent them from achieving a smooth flow of work through their systems. In each instance where the Impediment Impact Diagram was applied, it was with the intent of assisting the people in those teams, groups and organizations to broaden their understanding of their situation – to reveal the system to itself – and to help them identify and resolve significant impediments that confront them.

IV. THE IMPEDIMENT IMPACT DIAGRAM ACTIVITY

No special process or approach is required in order to use Impediment Impact Diagrams. Although this paper focuses on examples from teams using an agile approach to developing their products, the technique can be used by any team, regardless of their approach. Some groups used in the research behind this paper have employed the technique in end-of-Sprint retrospectives, release retrospectives and on-demand problem solving workshops. The end of a Sprint or release period is usually a good time to use this, when the team can focus together and are already reflecting on the previous Sprint or release. It can also be used at any time the group wants to get insight into their impediments. Other groups used in this research have had dedicated sessions for addressing impediments as the opportunity arose, or at the start of an agile transition period.

The activity described in this section uses a format similar to that used by Esther Derby and Diana Larsen in their book on agile retrospectives [19]. The author has found this to be an effective way of describing the activity and introducing it to teams and organizations.

A. Purpose

The group has lots of impediments, and they need to understand them from different dimensions so that they can make some decisions. Often they will want to know which of the impediments is having the greatest negative impact in their system. Looked at another way, they will want to know where they will get the greatest return on their time and energy. They will also want to know, for any given impediment, whether the team can resolve it themselves, or if they need help from outside the team.

B. Time Needed

20-30 minutes, depending on the size of the group and the quantity of impediments.

C. Description

The team or group works together to come to a consensus on what are the most impactful impediments getting in their way, and who can influence the resolution of those impediments. After this activity the team will have a picture of the relative impact of the impediments, which ones they can smash themselves, and which ones they need help to smash. The impediments could have come from a retrospective, brainstorming session or other forum. Note that this activity employs a form of facilitation technique called "affinity grouping", and in particular, uses a variation based on silent work methods that speeds up the activity, minimizes procrastination and hears from everyone in the group. The technique has also been used in a modified format for, among other things, sizing user stories [12].

D. Steps

- The facilitator introduces the activity by leading a short discussion on the relative impact of different impediments. If necessary or helpful, the facilitator will use the descriptions and definitions of impediment categories from TABLE I. above to get the team thinking about impediments. This is particularly useful for teams that are just getting started with thinking about impediments. The facilitator will point out that the team or group will be able to resolve some of the impediments, while other impediments will require help from outside the team or group.
- The facilitator points to the Impediment Impact Diagram already prepared on the wall, whiteboard or flipchart, and provides a few examples of impediments that fall under different areas of the grid.

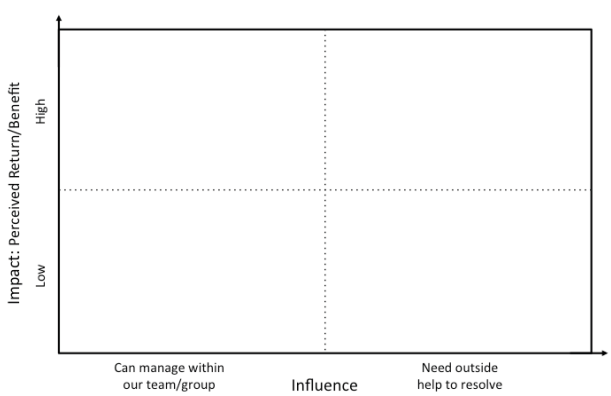

Fig. 6. Basic Impediment Impact Diagram. The horizontal axis represents the level of influence needed to remove the impediment.

- The facilitator describe the guidelines, explaining that the goal is to get a visualization of the impediments, and that the group are going to do this in two rounds, in silence. The goal of the first round is to quickly place all the impediments on the grid. Not everyone will get to input on every impediment in this first round. The facilitator reassures them that round two will provide them the opportunity to reflect on all of the impediments, and they will get to (silently) adjust whatever they want to. If the facilitator sees two or more people moving the same impediment back and forth without coming to agreement, then they will pull that one out for further discussion later.
- The group has a backlog of impediments on sticky notes arranged on the wall near the Impediment Impact Diagram's grid.
- The team lines up. One at a time, and without speaking, each person takes an impediment from the backlog and places it on the grid. This is repeated until all impediments are placed somewhere on the grid.
- Next, the group forms a semi-circle around the board. One at a time, and without speaking, anybody can step forward and move an impediment sticky note. The diagram in Fig. 7 shows an example of impediments placed on the grid.

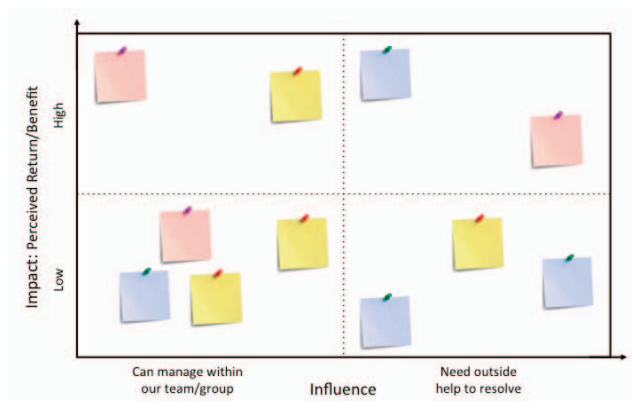

Fig. 7. Impediments are represented on sticky notes and placed on the board.

- Disagreement will show up as two or more people getting into a cycle of someone moving a sticky note, and someone else moving it back. When the facilitator sees this disagreement, they pull the sticky note out. There are usually two or three such sticky notes by the end of this round. These are the impediments that need some discussion.
- Discuss the impediments represented by the sticky notes that were pulled out.

E. Materials

- The group needs a large canvas for this exercise. A large whiteboard is good because it offers flexibility and the option to redraw parts of the grid during the exercise, as the facilitator adapts the grid to what the team is learning. An example of this is given in Section VII.E below. When a large whiteboard is not available then the facilitator will use two or four flip chart pages taped together to make one big canvas, and stick this to a wall.

- A backlog of impediments on sticky notes.
- Sometimes the group will use different color sticky notes to categorize the impediments. For example, if using the Scaled Agile Framework (SAFe) Inspect and Adapt workshop [20], the facilitator might use five colors of sticky notes to categorize the impediments as related to people, process, program, tools, and environment.

F. *Preparation*

The facilitator will take the following steps to prepare for populating the Impediment Impact Diagram:

- Create the grid like that shown in Fig. 6 above on a whiteboard (or other surface) in advance of the activity.
- Prepare the impediment sticky notes – one impediment per sticky note. It generally helps to position these on a wall adjacent to the Impediment Impact Diagram.

V. Variations

A. *Explicit Stakeholder Visualization*

Instead of understanding impact in terms of "in the team" or "outside the team", the group can get a richer mapping of impediments to stakeholder groups by using the horizontal axis to represent different groups. For example, they might use team, business unit, company as shown in Fig. 8.

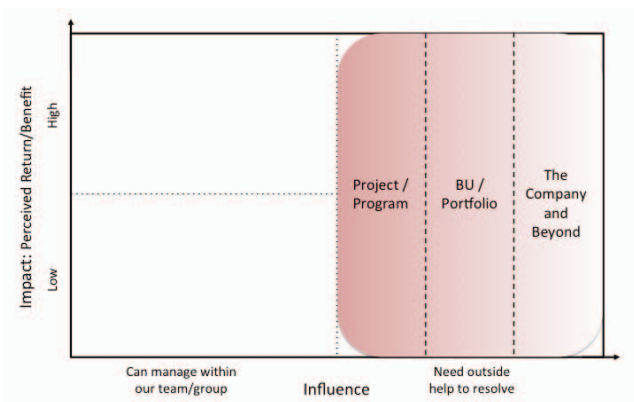

Fig. 8. Explicitly visualizing different stakeholder groups.

The participants could also consider a wider group of specific stakeholders, e.g., "this team", "team x", "HR", "Finance", "Sales", or "the executive team".

B. *Visualizing the Effort to Remove Impediments*

The group can use the same board to include additional factors such as relative duration, i.e., the relative length of time the team think it would take to resolve the impediments. The diagram in Fig. 9 shows an example of using the technique to get the group to also consider duration and risk.

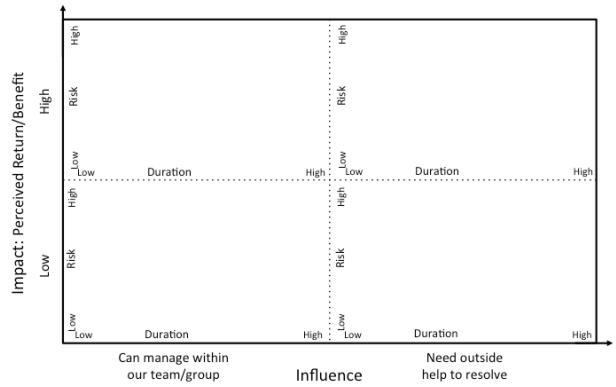

Fig. 9. Adding additional dimensions to the grid to visualize perceived duration to remove the impediment, and associated relative risk.

VI. Interpreting the Impediment Impact Diagram

Interpreting the information generated from the diagram is straightforward. Consider the example in Fig. 10.

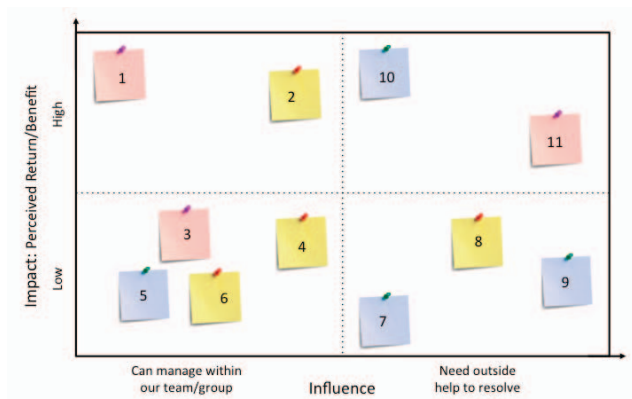

Fig. 10. Interpreting the Impediment Impact Diagram.

The impediments represented by the stickies numbered 1 through 6 can all be resolved within the team or group. The team or group need help from outside the group to resolve the impediments represented by the stickies numbered 7 through 11.

The impediments represented by stickies 1, 2, 10 and 11 have a comparatively higher impact on the team than the others. Removing these impediments would yield a relatively higher return.

All of this is objective information based on where the team places the impediments on the grid. This information is used to inform decisions around which impediments to remove first. Other factors will also inform that decision. For example, it seems that the impediment represented by sticky number 1 should be resolved first because it can be managed within the team, and has a high impact. However, there may be other factors that will influence that decision, for example:

- Team capacity. It may make more sense to remove this impediment later, given current team commitments. In

the meantime, one of the impediments 7-11 could be worked on without impacting the team's capacity.

- Availability of someone within the team with specific knowledge or skills relevant to the impediment. For example, if removing the impediment requires specialist knowledge of the build server configuration, and the person or people with that knowledge are unavailable, it may make sense to work on something else for now.
- Relative benefit of removing impediment 1 versus impediment 10 or 11.

In cases where the team is using additional dimensions such as difficulty and duration, deeper analysis is possible. Consider the diagram in Fig. 11.

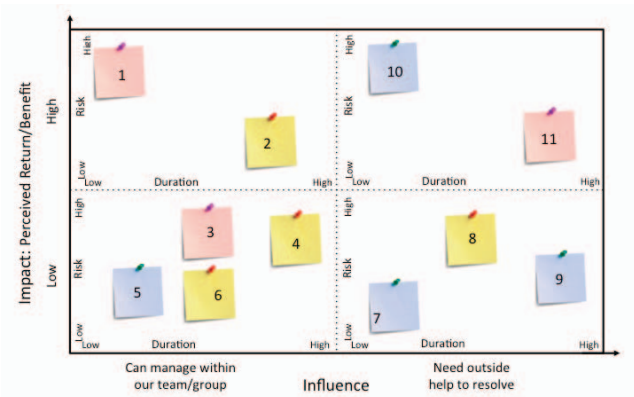

Fig. 11. Interpreting an Impediment Impact Diagram that includes extra dimensions for risk and duration.

The following list includes some interpretations that can be drawn from the diagram in Fig. 11 above:

- Impediment 1 and impediment 2 both have a high impact, and the team feel they can resolve both. Impediment 1 carries a higher degree of risk than impediment 2. Impediment 2 will likely take longer to remove than impediment 1.
- Impediments 3 and 6 will take roughly the same amount of time to remove. Impediment 3 carries more risk than impediment 6.
- Impediments 2 and 11 have similar impact, carry similar risk and are predicted to take about the same time to remove. Impediment 2 is manageable within the team, while impediment 11 needs outside influence to remove. Similar statements can be made for comparing impediments 1 and 10, or impediments 3 and 8.

VII. Examples

A. Introduction

This section presents the experiences of the teams and groups described in section II above, and detailed in TABLE II.

B. Example A1

The group consisted of program and project managers, and their director. This group is responsible for running programs for over 2000 engineers across the US, Europe and China.

The team went through some activities to identify impediments, and had a backlog of impediments represented as sticky notes on a wall. The photograph in Fig. 12 shows the team creating the backlog.

Fig. 12. The team prepares the impediment backlog. The impediments were identified in earlier activities.

The photograph in Fig. 13 shows the team engaged in round one of the activity to place impediments on the Impediment Impact Diagram grid.

Fig. 13. Members of the group from Case A1 engaged in Round 1 of the Impediment Visualization activity. The backlog of impediments can be seen on the center whiteboard wall. The Impediment Impact Diagram is drawn on the whiteboard wall on the right.

As the activity unfolded, the impediments are shown on the Impediment Impact Diagram. A snapshot for the team in Case A1 is shown in Fig. 14.

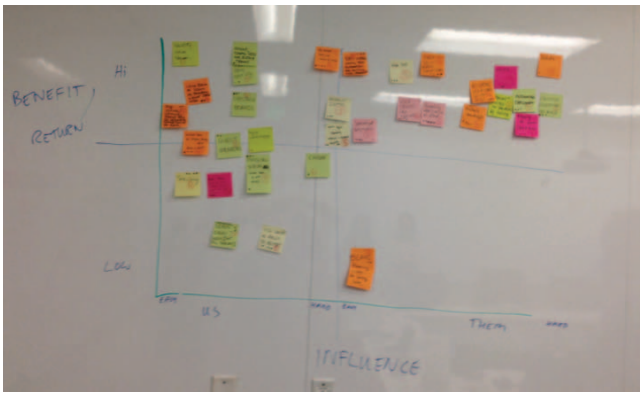

Fig. 14. Impediments represented as sticky notes on the Impediment Impact Diagram for the team in Case A1.

One of the program managers said that this activity helped them get a clear perspective on the impediments that are within their ability to remove themselves and those that are not. The group ended up creating two lists of impediments after the activity. The first was a prioritized list of impediments that are in their control to remove. The second was a prioritized list of impediments that they need to engage with other people to remove.

C. Example A2.1

The Scrum team was in a Sprint retrospective, and they had identified a large quantity of impediments. They were trying to decide which issues they should tackle first. The Impediment Impact Diagram gave them a fast way to prioritize and make decisions.

D. Example A2.2

A group of Scrum teams and program managers had come together for an end-of-program retrospective after a milestone release of their product. The Scrum team represented in case A2.1 are one of the teams included in case A2.2. Not all the product owners and managers attended, which itself was noted as an impediment.

One decision this group made was to deliberately tackle the "low hanging fruit", i.e., those impediments that were not necessarily high impact, but were within their scope to remove. They wanted to avoid the accumulation of a large quantity of impediments, and wanted to know, when capacity came available, which impediments were good targets. The Impact Diagram gave them a way to see this. In a complex system, making any change has effects across the system. Apart from the benefits of removing the impediments, dealing with the "low hanging fruit" gave the team members more confidence in dealing with impediments generally. It helped them to develop the habit of identifying and removing problems by providing them with some low-risk options that turned out to be useful for learning and embedding the process.

E. Example A3

The group had representation from engineering, product management, program management, quality assurance and user experience. They were all senior people in the organization, and included several senior managers and directors.

Midway through the exercise the group realized it would make sense to be more granular than "in the team" and "outside the team". They identified different areas of focus for impediment removal as shown in Fig. 15. These included in the team, across the site, in the product scope (including another group they work with at a US site), and outside the product scope.

Fig. 15. Impediment Impact Diagram with additional stakeholder groups identified and added during the activity.

This gave them a clearer focus on who needed to be involved to influence the impediment removal.

F. Example B

The group were all senior people in the organization, and together they were responsible for the end-to-end lifecycle of delivering projects. They had representation from architecture, engineering, product management, project management, quality assurance, IT operations and customer support .

The group identified 91 distinct impediments that were categorised under the headings in TABLE I. Each of the 91 impediments was represented by a sticky note. Using the steps of the activity outlined in section IV, and a large grid like that in Fig. 6 above, the group were quickly able to get a visualisation of the impediments and make decisions about which ones to address. The group reported that this gave them a way to begin to understand how to manage the large volume of impediments, and were quickly able to start to make progress on removing the impediments.

VIII. Analysis

This section presents an analysis of some of the research findings to date.

A. Understanding Impediments

The activity and techniques presented in this paper give teams and organizations deeper insight into the impediments they are uncovering. Rather than simply treat everything as of equal importance, the Impediment Impact Diagram helps teams to see the relative impact of each impediment. Further, it helps them to decide whether they feel they can remove it themselves or need outside help, and gives them a fast means of articulating that to themselves and their stakeholders.

The grid on the Impediment Impact Diagram can be customized to be more specific about which different stakeholder groups are needed to remove the impediment.

The grid on the Impediment Impact Diagram can be extended to show additional attributes that help the team understand the impediments. This paper used risk and duration as common examples, but others are possible.

B. Aid to Organizational Learning

The impediments that are identified are causes for celebration. They present the teams and organization with an opportunity to not just improve the flow of work through the system, but to learn something about the underlying causes of the impediments. Removed impediments become a record of improvements the teams and organization have made. The experiences gained through identifying and removing the impediments become a source of shared learning.

C. Understanding Systemic Issues

By keeping track of impediments over time, their relative impact, and the stakeholders required to influence their removal, it is possible to see systemic patterns emerge. For example, a common scenario is the lack of availability of user experience designers. Multiple agile teams are reporting this impediment, and requiring senior management to get involved in removing the impediment. A less obvious example might point to the systemic issue of multiple teams not talking to each other, leading the teams to identify issues around team dysfunction, trust, and coordination.

D. Finding the Difference that Makes a Difference

The science behind complex change shows that something will shift in some way in response to any change made in a human system. Even the absence of perceptible change is feedback. However, given the limited time and energy that people have to invest in removing impediments, it is useful to have some way of making decisions that are more likely to have a higher return on that investment.

Adaptive Action talks about "the difference that makes a difference" [9]. One way to think about this when looking at impediments is to ask which ones, if removed, would really make a difference in the system? Looking at the Impediment Impact Diagrams in Fig. 10 above the impediments that really make a difference, compared with the others, are the ones numbered 1, 2, 10 and 11.

E. Finite and Infinite Games

Complexity sciences talk about finite and infinite games [8]. Some impediments are big open-ended problems. The Influence Impact Diagram helps us to see this. The impediment is huge, resolving it falls outside our sphere of influence. Resolving it is an Infinite Game. Understanding this distinction, we can then ask ourselves what we can we do to tackle the complexity, and treat at least part of the problem as if it were a finite game? That at least allows us to make some progress on an otherwise sticky issue.

F. Span of Control

Participants in the exercise often find that a high percentage of the impediments they identify are within their span of control to remove. It is common for large clusters of impediments to group in the upper left side of the diagram, meaning they are both high impact and within the team's control. The quantity can range from 60% to 95%, on average. This has a number of effects. The first reaction is usually surprise, followed by a recognition of the significance of the realisation that so much is within their control. This is a good time to have a discussion about empowerment and control with the group. The majority of impediments they face are within their own control to remove.

G. Limitations

The impact of an impediment can be subjective. It can be difficult to quantify the precise impact of the impediment, or benefit of removing it.

A team's confidence in their ability to remove impediments is a reflection of the organization culture. This paper did not factor in the culture of the organization, and its effect on the teams and organizations.

Because the researcher is a "research facilitator" and the participants are also closely involved with the work, there is a danger of researcher bias.

IX. Future Work

The researcher is continuing to apply the Impediment Impact Diagram with teams and organizations around the world. The research is providing and interesting and useful analysis of impediments in agile development teams and organizations. The research has provided a large body of data to date, and the researcher is currently coding that body of data for further analysis. Current and future work is focused on these primary areas:

- Pattern analysis: Patterns in impediments and impediment impact across teams in the same organization. Patterns that show up across different organizations.
- Cultural analysis: Understanding how different cultures perceive impediments, and the impact of impediments. Also, understand the degree of influence they have, both actual and perceived, on other stakeholders.
- Effect on organization culture. Part of the research focuses on the culture created in the organization when

teams and stakeholders cooperate to remove impediments.

- Using Landscape Diagrams to better understand where impediments sit in terms of stability in complex systems.
- Role of Management in Agile Teams and Organizations.
- Effect on team autonomy. Removing impediments and creating a culture of problem solving within the team and organization.
- Effect on team performance.
- Effect on team velocity.

The Impediment Impact Diagrams is a useful tool in all of these areas of research.

X. CONCLUSIONS

Teams and organizations face many impediments as they attempt to navigate the system and get work done. Beyond identifying the impediments, it helps to have techniques to analyze and understand the impediments. The Impediment Impact Diagram introduced in this paper is one such technique that helps teams and organizations make decisions around where to invest their time and capacity. It reveals the impact that the impediments are causing, and the benefits to be gained by removing the impediments. It helps teams and organizations to understand who they need to influence in order to remove specific impediments.

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