

# Value Stream Mapping in a Service Environment: A Comparison of Approaches

*Tammi Sinha [Tammi.Sinha@port.ac.uk](mailto:Tammi.Sinha@port.ac.uk)  
Portsmouth Business School, University of Portsmouth UK*

*Nigel Ward  
National School of Government UK*

*Christine Welch  
Portsmouth Business School, University of Portsmouth UK*

*Briony Boydell  
Portsmouth Business School, University of Portsmouth UK*

## **Abstract**

This paper provides an analysis of Value Stream Mapping (VSM) tools. It offers an insight into the benefits, enablers, drawbacks and blockers for VSM approaches with the expertise of a community of practice of 20 improvement professionals from service environments. A single scenario was used to test the methods in terms of visual representation, team understanding, team interaction and the richness of the data displayed. The results showed that each approach had value but that building complexity and adding richness of data improved the overall outcome. A framework and key messages conclude.

**Keywords:** Visualisation, Value Stream Mapping, Lean Service

## **Introduction**

The paper examines the use of value stream mapping in a service environment, by improvement practitioners in order to identify current / best practice. The paper offers an insight and comparison, into five Value Stream Mapping (VSM) approaches using a single scenario in order to explore strengths and weaknesses in the different VSM process outcomes. This is in terms of visual representation, team understanding and interaction, and final richness of data displayed.

VSM, as a tool for revealing the messy and dynamic nature of supply chains and business processes are well known and established, and are used widely by improvement practitioners. Authors such as Hines and Rich (1997), Jones and Womack (2002), and more recently Stevens et al (2009) have provided reviews and a robust VSM kit for practitioners which have included the consideration of both operational and strategic aspects. Value chain was a term originally cited from Michael Porter (1989) and has been embraced more recently by the term value stream as more writers consider the importance of value from various stakeholder views.

Value is perceived as the focus of the analysis and is reflected in such terms as value stream, value grid (Pil and Holweg, 2006) and value system (Stevens et al, 2009). It is

generally accepted that 'value stream' takes a strategic view of the process under analysis and as such is complementary to a systemic approach to process analysis. Value stream mapping covers a wide range of tools, with the 'learning to see' map appear to take the lead in many organisations. This paper will explore additional approaches used by improvement facilitators and practitioners predominantly in service environments namely the civil service, the Royal Navy, and other public sector organisations.

VSM may be defined as 'a technique to analyse the flow of materials, information and people in order to fulfil an order whether that order is for a product or service'. It is a visualisation tool which is used by facilitators and improvement practitioners to identify the current, ideal and future state of a value stream / business process / supply chain / set of activities. VSM developed from the Toyota production system and is used to promote fast, flexible flow by identifying value from the end customers' perspective, in a service environment it is helpful to define value from the multiple stakeholders view and ensure these views are considered when mapping. Another way of describing this activity is 'staple yourself to an order' (Shapiro et al, 1992) whose paper talked about order management control, but this concept has developed into what we now know as value stream mapping.

This paper explores the use of the following techniques for value stream mapping:

1. Process mapping / SIPOC diagram.
2. Swim Lanes.
3. Service Blueprinting.
4. Four Fields Mapping.
5. A3 / Route Learning Maps.

When mapping, it is important to define boundaries to ensure the scope of the map is understood (what is in and what is out of the map) this will be influenced by the stakeholders and the team developing the map. This can be achieved by building the root definition of the process to be mapped, and tested using the mnemonic CATWOE (Customers, Actors, Transformation, Worldview, Owner and Environment). The root definition also defines what activities are involved and in what order.

The tools analysed in this paper may be signposted as 'Brown Paper Mapping' so called as the tools use a large scale format to map an existing process, with the objective being 'rough and ready' analysis rather than a complete, precise, neat and tidy document. Brown paper mapping may be described as 'a structured way of mapping and critiquing the existing process, in order to examine its effectiveness along a number of dimensions. It is said to encourage team efforts to identify critical elements in the process and locate potential areas for improvement' (IFM 2010) 'A brown paper technique which uses the power of the team to plan a change implementation while building team ownership of the output' TDA 2007. The suite of techniques may be summarised as follows:

- High level diagram to show main product / service flow and stages.
- Captures and visualises an entire value stream / or a part depending on where you draw your boundary.
- Uses additional visuals to show problems, milestones, activities, interfaces, decision points and deliverables.

## Mapping Techniques Used in Workshop

### *Process Mapping*

Process mapping is a workflow diagram to bring forth a clearer understanding of a process or series of parallel processes. It is also known as Process Charting or Flow Charting. It is one of the oldest, simplest and most valuable techniques for streamlining work. A process map visually depicts the sequence of events to build a product or produce an outcome. It may include additional information such as cycle time, inventory, and equipment information. Several systems of conventions exist; although the original system invented by Frank Gilbreth in the early 1900's is still the most useful. The Gilbreth approach is highly visual and discriminates between waste and value-added activity.

### *SIPOC*

A SIPOC diagram is a tool used by a team to identify all relevant elements of a process improvement project before work begins. It helps define a complex project that may not be well scoped, and is typically employed at the Measure phase of the Six Sigma DMAIC methodology. It is similar and related to Process Mapping and 'In / Out of Scope' tools, but provides additional detail.

The tool name prompts the team to consider the Suppliers (the 'S' in SIPOC) of the process, the Inputs (the 'I') to the process, the Process (the 'P') that is being improved, the Outputs (the 'O') of the process, and the Customers (the 'C') that receive the process outputs. In some cases, Requirements of the Customers can be appended to the end of the SIPOC for further detail. The SIPOC tool is particularly useful when it is not clear:

- Who supplies Inputs to the process?
- What specifications are placed on the Inputs?
- Who are the true Customers of the process?
- What are the Requirements of the customers?

### *Swim Lane / Deployment Maps*

A Swim Lane diagram, or Cross-Functional diagram, is a process flowchart that provides rich information on who does what. It can also be expanded to show times



when tasks are done and how long they take. The visual metaphor is a swimming pool, with each participant in the process assigned to 'lanes'. Swim Lane diagrams take more time to develop, but enable teams to identify *time traps* which processes take the longest, as well as *capacity constraints*, or which resources get bogged down because of work. Ideally, after identifying the current process, teams should try to map out a better process, based on the information provided in the diagram.

### *Four-Fields Mapping*



Four-Fields Mapping is a Japanese variant on project management that is deliberately designed to put greater emphasis on teamwork and quality, whilst retaining useful aspects of traditional planning. The four fields are:

- Team members who will work on the project.
- Phases of activity that give shape to the overall project.
- Tasks which are to be done to complete the project.
- Standards by which task completion are to be evaluated.

The Four-Field approach uses a simple mapping system similar to swim lanes and provide holistic approach.

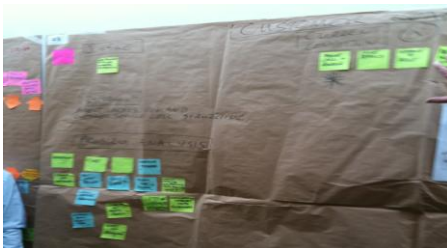
### *Service Blueprinting*



Initially introduced as a process control technique for services that offered several advantages; it was more precise than verbal definitions; it could help solve problems pre-emptively; and it was able to identify failure points in a service operation. Service Blueprinting distinguishes between onstage and backstage activities. These key components form the basis of the technique and its most

important feature, illuminating the customer's role in the service process. In addition, it provides an overview so that employees and internal units can relate what they do to the entire, integrated service system. Blueprints also help to reinforce a customer-orientation among employees as well as clarify interfaces across departmental lines. There are five components of a typical Service Blueprint: 1 Customer Actions, 2 Onstage / Visible Contact Employee Actions, 3 Backstage / Invisible Contact Employee Actions, 4 Support Processes, 5 Physical Evidence.

### *A3 Mapping*



The most basic definition of an A3 is a P-D-C-A (Plan-Do-Check-Act) storyboard or report, reflecting Toyota's way of capturing the PDCA process on one sheet of paper. However the broader notion of the A3 is that it captures the heart of the Root Cause and structures effective and efficient dialogue that fosters understanding followed by the opportunity for deep agreement. The A3 as a tool

engenders communication and dialogue in a manner that leads to good decisions, where the proposed countermeasures have a better chance of being effective because they are based on facts and data gathered at the place where the work is performed, from the people who perform it.

### **Methodology**

The data was collected through a series of 2 workshops. One of the aims of these workshops was to establish a Community of Practice (CoP) in business applications of systems thinking, process management and other related practice. Twenty experienced facilitators were provided with an identical scenario and asked to develop an 'AS IS'

representation using one of the VSM techniques. The outcomes in terms of representation, process, success and learning were analysed and debated in order to provide a useful comparison for VSM practitioners.

An introduction was given to the range of techniques to be considered: Swim Lanes, Service Blueprinting; Four-Fields mapping; and A3 Route Learning Maps.

In relation to a collaborative undertaking such as this, the CoP reflected on a quotation from Mark Twain: 'It ain't what you don't know that gets you into trouble. It's what you know for sure that just ain't so.' in Booth-Sweeney and Meadows (1995). This emphasised a need to surface and test the underlying assumptions before embarking on analysis. This exercise in collaborative learning involved a number of activities: Mobilise, Discover, Deepen, Develop, Deliver.

This was important in order to share understanding and to build consensus. The CoP was analysing the methods in terms of:

- Visual representation.
- Team understanding.
- Team interaction.
- Richness of data.
- Consistency (Predictable customer experiences, Global business model).
- Repeatability (Best practice transfer, Business predictability).
- Clarity (Tracing and readiness, Role accountability).
- Performance Optimisation (Key Performance Indicators, Automation).

A case study scenario (Short-term Loans) was then distributed as the basis for a workshop activity relating to current state mapping, and an extract is presented below:

*“Having watched a television advert, the customer rings a service centre and asks for an application pack for a new secured loan at the promotional rate. They work their way through the telephony system until they get to speak to an operator. However to achieve this there were 4 option choice to listen to and on pressing the option number the sequence was repeated a further 4 times. On the final option a standard message of ‘Due to high demand all the operatives are engaged and your call can not be taken at present, please call back later’. After a half hour wait the customer attempts the call again this time after going through the options hears the message ‘We are currently receiving a high demand of calls, please wait as you are number 6 in the queue and your call will be answered as soon as possible’. After listening to this message for 10 minutes the call is answered by a human operative. The service centre operative duly notes the customers post code and details before instructing the system to print out the promotional material etc for the policy holder. The average operative / customer engagement takes 10 minutes with approximately 10% of rework. The instructions at the print department is held in a queue for about a day before all letters for that post code are batched together and printed. The printed offer letters take a day to print and then go by 2nd class to the customer arriving 2 days later. The potential customer reviews the offer letter and completes the simple questionnaire and direct debit form and sends them back to the local branch. The mail arrives at the branch and is opened; at this stage there is a 30% chance of forms being in complete and having to be returned for additional information. The mail is then sorted and put into batches waiting processing by the relevant back office operator. Here it is noticed that the potential borrower is under the age of 18 despite being in full time employment and therefore requires a guarantor. A letter is resent to the potential borrower requesting a guarantor by 2nd class post. The letter is duly returned 2 days later in the prepaid 2nd class envelope after getting the form signed by her father with supporting documents about the father’s proof of earnings. The application is then processed and a letter of offer returned to the potential borrower. The signed contract is returned to the branch. The computer system is updated. The*

money is then transferred to the borrowers account and a letter sent out to confirm the deposit has been made and triggering the printing of a cheque book and credit card taking a further 3 days. The direct debit system is updated and monthly repayments are scheduled.”

Four groups of participants were established, each adopting a different method with which to attempt mapping of the processes described in the scenario (Swim Lanes, Four-Fields; Service Blueprinting; A3). Each group was given a large wall or floor-mounted brown paper sheet, pens and Post-It notes in a variety of colours. One-and-a-quarter hours were allocated for this first part of the activity and the Workshop Facilitators circulated and gave advice, comment and feedback to the groups as they worked. Groups were selected at random on the basis of coloured Post-It notes stuck to the participants’ chairs before they arrived.

Once the groups had produced their maps, and had had an opportunity to reflect on feedback from the facilitators in order to modify and improve them, they gathered in a plenary session around a large wall-chart divided into quadrants labelled with the questions: ‘What went right?’, ‘What went wrong?’, ‘What helped?’, ‘What hindered?’. Each group reflected on these questions and recorded their thoughts on the chart, using colour coded pens according to their particular mapping technique. In this way, a comparison of the strengths and weaknesses experienced with each technique became possible. Next the groups circulated to view one another’s maps and each group appointed a spokesperson to present the results of the exercise. Comments/queries arising from these presentations included the following:

*Table 1 – Comments from CoP*

<i>Swim Lanes</i>	Care is needed not to focus on the dots (identified waste) too quickly or to find yourself focusing on trivia. Further work on waste is needed on an iterative basis. Resources, time, etc. are shown clearly. Map is easy to interpret. No solutions are offered. There are many unknowns.
<i>Service Blueprinting</i>	How was boundary setting dealt with here? Was CIPOC used? Answer – No. CIPOC would not be useful for a multiple process since it focuses on high level
<i>A3</i>	Information lacking. One issue must be identified. What is the issue? How do you know what to improve? e.g. is this a marketing issue – loss of business? Is it about duplication of effort or delays? No measurement is included in the scenario. Performance Indicators are needed. Identification of PIs is part of the A3 technique.
<i>General comments</i>	The challenge is to define what the problems are (before they can be addressed). How do you capture the ‘magic’ processes that nobody thinks are supposed to happen? i.e. are we mapping the formal system or the informal system – what people say happens or what really happens? E.g. Suppose Fred says that he gives work to Jim but Jim says he gets his work from George – how does this work out when mapping processes? Feeding back to the customer and reflecting on their reactions would enable further improvements in mapping – e.g. identifying key issues, setting boundaries

These comments naturally arise where a fictitious scenario is used but highlights the need for boundary critique; key stakeholder is customer. The processes described in the scenario form part of a wider system; where is boundary to be drawn for mapping? How is the interface between them to be managed?

## **Findings**

The following evaluations were recorded in the second workshop.

### *Swim Lanes v1 and v2*

This appeared to be a good way to view the interactions between ‘lanes’ [SIPOC] and also duplication of effort in the overall process. It enabled the group to see which activities were adding value and which not. It was possible to highlight delays and see which were controllable and which not, e.g. due to external postal service. However, the view displayed depended upon the perspective reflected in the map customer? manager? It was noted that little detail was available and that the exercise had generated more questions than answers. This was partly due to use of artificial scenario with limited material, however it also served to highlight the possibility that we sometimes race to develop solutions before we have a full enough picture of what the problems really are. This group appeared to have shared out the work of mapping among them quite effectively at showing up duplicated efforts in the process.

### *Swim Lanes .3*

This exercise had been carried out by a group of rather sceptical people. One particularly cynical person rather disrupted the group. However, he later called to say that he had, in fact, found the technique useful in a practical context and so had changed his view. The group carried out the exercise in a meticulous, if not regimented fashion. They did not take individual roles but carried out the whole mapping task collaboratively, achieving consensus on each lane as a group. A time-line was added by this means.

### *Service Blueprinting*

This technique serves to show ‘moments of truth’ in processes and ‘touch points’ between the system and the customer clearly. In other techniques, activities by the customer are not included. Blueprinting is useful, therefore, in highlighting the impact of such things as ‘customer watches TV advert’. This yielded useful material for reflection that would not be captured in, e.g. Swim Lanes.

### *A3 Mapping*

This technique would normally start with a defined issue, then map the current situation, customer value stream and an analysis of problems. Two groups had used this technique. The first had created a picture of the whole story as a high level process. The second created an analysis using Post-It notes. In this case, what started as a ‘issue’ was later recognised as too high a level and it was boiled down into questions for the client that would lead to elaboration of issues for mapping, and illuminate problem analysis. Two points were highlighted here; 1 A need to set boundary for particular perspective, 2 The difficulty in attempting to map issue / problems in the absence of performance measures.

### *Four-Fields Mapping*

This maps value stream with resources and time added in separately. The time line is generated by unrolling the paper to enable the map to progress. This means that time delays are represented by blank space delays therefore become very clearly apparent. The technique takes time to develop but tells a complete story.

*Table 2 – Team and Individual Feedback on VSM Tools*

<b>Technique</b>	<b>What Went Right?</b>	<b>What Helped?</b>
Process Mapping YELLOW	High level picture Aids communication Way of breaking down the process	Can be built up over time. Liked by QA bods – ISO compliant but not friendly. Can cut and paste into

		standard procedures. Focus on process flows and outputs. High level buy in
A3 LIGHT GREEN	Can help define problem statement Sets process maps in a wider context Clear summary of situation	Someone who can draw
Four-Fields ORANGE	Draws attention to space. Emphasises time line and activity gaps. Good to prioritise efforts. Brings out resource requirements	Visual map to show excess time – missing documentation – V like it!
Service Blueprinting BLUE	Team involvement	Mental maps. Straight forward, between graphic and written. Includes organisational aspects. Ask how and when it happened
Story Board DARK PINK	Easy to understand, simple way to see whole picture. Very appealing visually. Easily understood. Capture wide view	Dynamic, Quick, Having more than one
Blended Approach LIGHT PINK	Suits all – left hand and right hand brain dominance	Brilliantly presented
Swim Lane and Timeline LILAC	Shows handovers and interrelationships between teams / departments. Easy, quick, simple. Shows the process flow. Clearly shows organisational touches	Cheap to produce

<b>Technique</b>	<b>What Went Wrong?</b>	<b>What Hindered?</b>
Process Mapping YELLOW	Time consuming to produce. Value of output? Reality changes very quickly Don't use proprietary software if you can help it	Discipline can get in the way Involvement of stakeholders Stakeholder rep changing mid way
A3 LIGHT GREEN	No comments	No comments
Four-Fields ORANGE	Resource intensive	Amount of space and paper needed. Takes too long
Service Blueprinting BLUE	Find difficult to teach so tend to keep away. Limited information	Limited to experience of the team Full knowledge Layered depth
Story Board DARK PINK	Will those that can't draw feel involved? No data. Can lack credibility. Subjective artist can manipulate	Doesn't suit LH brain individuals Drawing skills
Blended Approach LIGHT PINK	Language	New person coming into team – not transparent as to approach Not good for stakeholder management
Swim Lane and Timeline LILAC	Every version different for same process. Fatigue at end of process	Who needs it? Scale

Table 3 – Even Better If.....



<b>Technique</b>	<b>Think about CATWOE for all</b>
Process Mapping YELLOW	Other tools and methods used where appropriate
Four-Fields ORANGE	Create swim lanes first then add resources
Service Blueprinting BLUE	A design icon could be added
Story Board DARK PINK	Animated – cartoons? Blend with data
Blended Approach LIGHT PINK	Co creating value Group engaged in selecting tools in blend
Swim Lane and Timeline LILAC	Understand strategy – production up costs down

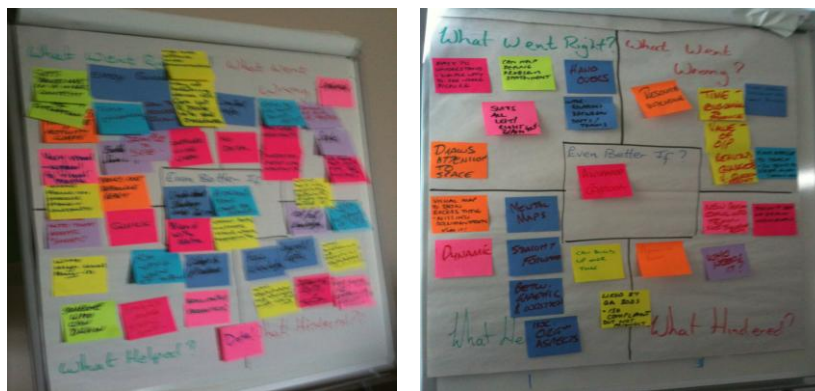


Figure 1 – Feedback from Workshops

The results showed that each approach had value but that building complexity and adding richness of data improved the overall outcome, debate and team learning.

### Key Messages

The key messages from this research are the following:

- Ensure boundary is known and shared.
- Use a technique which is understood and accepted by the team.
- Ensure the stakeholders views are incorporated into swim lanes.
- Use a mixture of visualisation techniques to engage right brain and left brain team members.

There is a natural progression from SIPOC to swim lanes, from swim lanes and timelines, to Service Blueprinting, to Storyboarding, to Four-Fields Mapping and eventually to the A3 which is a Blended Approach showing the improvement path. This progression shows that teams need to build up complexity in layers and progressively, as the team develops expertise and experience in both value stream mapping and visualisation techniques.

### Relevance and Contribution

The paper contributes to theory by exploring the approaches using a single scenario and to managerial practice by providing key strengths for each approach. Future research will explore these methods in more detail in different but complementary scenarios. The findings will be useful for practitioners and academics as the focus group participants are all experienced facilitators in improvement from the service sector.

Table 4 – Framework for VSM Tools

	Process Mapping / SIPOC	Swim Lane / Timeline	Four-Fields	Service Blueprinting	A3 / Blended Approach
<b>Visual representation</b>	X	X	X	X	X
<b>Team understanding</b>	X	X	X	X	X
<b>Team interaction</b>			X	X	X
<b>Richness of the data displayed.</b>			X	X	X
<b>Consistency</b>					
Predictable cust exp	X	X	X	X	
Global business model	X	X	X		
<b>Repeatability</b>					
Best practice transfer	X	X	X	X	
Business predictability			X		
<b>Clarity</b>					
Tracing and readiness			X		
Role accountability			X	X	
<b>Perf Optimization</b>					
KPIs			X	X	
Automation	X		X		

This paper aimed to provide an analysis of VSM tools, to provide a resource for managers and improvement practitioners to choose the appropriate VSM tool for their needs. It offered an insight into the benefits, enablers, drawbacks and blockers for VSM approaches with the expertise of a community of practice of 25 improvement professionals from service environments. A single scenario was used to test the methods in terms of visual representation, team understanding, team interaction and the richness of the data displayed. The results showed that each approach had value but that building complexity and adding richness of data improved the overall outcome, debate and team learning. The framework can be used as a starter for leading VSM sessions and the key messages for managers and practitioners provide a checklist for successful and useful mapping sessions.

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