

Augmenting Value Stream Mapping¹ by Possession, Ownership and Availability

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Abstract. Value stream map (VSM) is a special type of flow chart used in lean manufacturing to depict and improve the flow of material and flow of information. Possession, ownership and availability (POA) is a modeling framework for design of enterprise information systems using flows of economic resources in enterprises or business ecosystems. This paper compares these two modeling techniques and identifies the benefits of using value stream mapping augmented by the POA semantics.

1 Introduction

Value stream map (VSM) is a special type of flow chart used in lean manufacturing to depict and improve the flow of inventory and flow of information (Storch 2010). The purpose of lean manufacturing is to make the flow more efficient by minimizing waste, such as wasted time, unnecessary motion, or excess inventory. A value stream map is a graphical representation of the value stream, including material and information flows. It shows the flow of steps in product management and information systems that support value-adding activities.

The Possession, Ownership and Availability (POA) modeling framework (Scheller and Hruby 2016) represents the creation, flow, and consumption of economic resources, expressed as flow of possession, flow of ownership and flow of availability.

The POA model also shows the flow of steps in product management and information systems the support value-adding activities, but from a different perspective than value stream mapping.

In this short paper we provide an example of a simple manufacturing process represented both in the value stream map and in the POA model. We will compare differences between them and illustrate areas where the value stream map would benefit from considering adding the POA semantics to the value stream map.

2 Concepts

Concepts such as flows, value and information have different semantics in the value stream map and in the POA model.

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Value

In the value stream map (VSM), the value is a capability provided to a customer, *defined by the customer* (Storch 2010, Martin and Osterling 2013). Examples are quality, right time of delivery and appropriate price, and can be measured absolutely using the quantities of contributing features. The VSM value definition carries a certain aspect of contract negotiation – if we deliver you the quality, at the right time and at appropriate price, would you buy? It might indicate that VSM is primarily targeted to business-to-business scenarios rather than to business-to-consumer, where it is often difficult to find how the consumer determines the value.

The value of an economic resource in the POA model is determined by observing the exchange processes, and cannot be measured absolutely, only relatively, by comparing the value of the resource to the values of other resources at the time of exchange. For example, when Elwood of Blues Brothers traded Cadillac for a microphone, under the given circumstances the microphone had *higher* value for Elwood than the Cadillac, which Jake of Blues Brothers acknowledged: “OK, I can see that” (Dendis, 2011, Wilson 2018). From the POA model we cannot determine whether Elwood wanted microphone because of quality, time of delivery and appropriate price; the only fact the POA model tells us, is that the microphone had higher value than the Cadillac at the time of exchange.

Both approaches are useful. Using the VSM definition, knowing what features of a product are valuable for the customer, helps to design the product the customer might eventually buy. However, using the POA definition, we cannot be sure that the product has any value for the customer, until the customer actually buys it.

Flow

A flow in the value stream map is an “item” that flows through a value stream (Storch 2010). Examples are *materials* in manufacturing processes, *designs* in design and development processes, *external customer needs* in service industry, and *internal customer needs* in administrative processes.

In the POA model, a *flow* represents the *transfer* of possession, ownership, or availability of an economic resource from one role to another, or the *creation* or *consumption* of an economic resource (Scheller, Hruby, 2016). A flow can also be a *flow of information* from one role to another, see below.

Information

In the value stream map, the information flow is not precisely defined and is specified only intuitively, and focuses on the actual mechanism of delivering information, rather than what the information actually means in the context of the analyzed process.

In the POA model, information is an economic resource. Consequently, a flow of information is a flow of possession, ownership and availability of information from one role to another. Information is special, compared to other economic resources, because a provider can send information to a recipient without losing it. In other words, a flow of information does not change the possession, ownership, or availability of that information for the provider, but does make the information available (and optionally owned and possessed) to the recipient.

Other concepts

The value stream map can contain several other concepts such as timeline, showing value-adding times (cycle times) and non-value adding (waiting) times; inventory, shipment, material push flow, material pull flow, kaizen burst, highlighting the need for improvement, glasses icon, indicating visual gathering of information, sticky man for verbal communication, wiggle arrow indicating electronic communication, solid

line for manual flow of information such as memos, and reports, and a number of icons related to Kanban, such as Kanban signal, Kanban post, Kanban stockpoint. Some of these concepts are illustrated in Fig. 1

Main POA concepts are economic agents, roles, economic resources, repositories and flows of possession, ownership and availability of the resources. The full list of concepts is included in the POA metamodel in (Scheller, Hruby, 2016).

To summarize, the value stream map focuses mainly on the actual mechanisms supporting and enabling the material and information flows, while the POA model focuses on their economic semantics.

3 Example of a Manufacturing Process in VSM and POA

Example of a manufacturing process in the value stream map is illustrated in Fig. 1. A manufacturer delivers metal foils on Tuesdays and Thursdays. The metal foil is stamped, assembled, packed and dispatched the Customer/Recipient. Manufacturer deployed an MRP system for production control, that receives 90/60/30 day forecast and a daily order from the Customer/Recipient, sends 6-week forecast and weekly order to the Supplier, and produces weekly schedule for the stamping and assembly stations, and a daily ship schedule to the pack-and-shipping station.

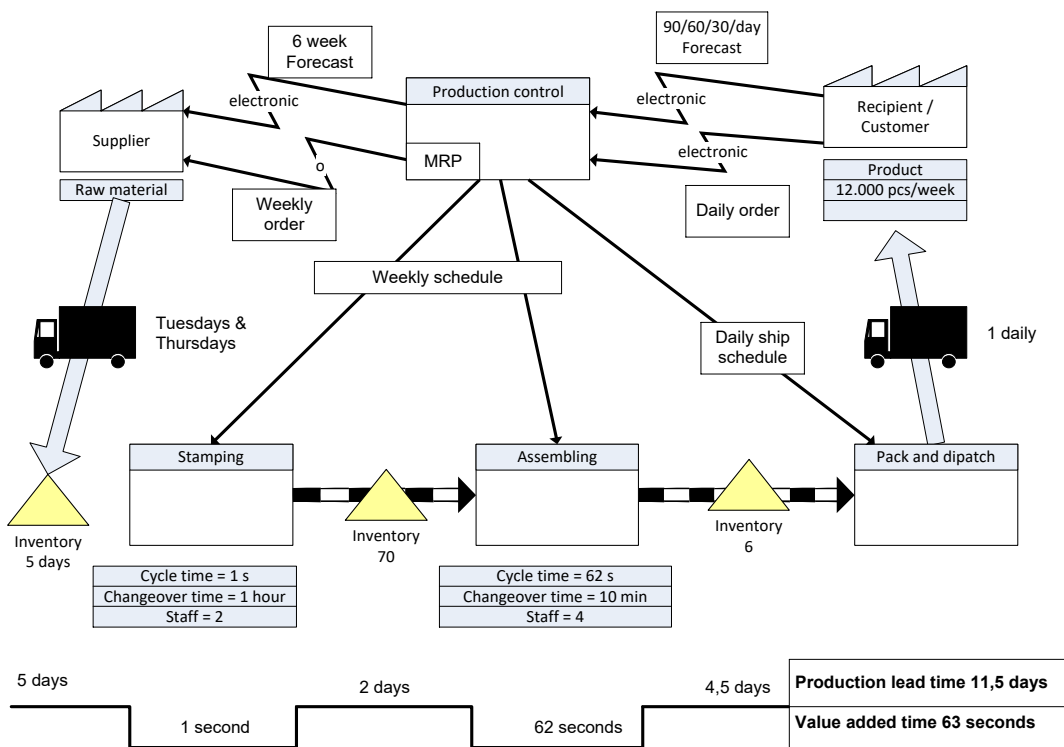


Fig. 1. Example of a manufacturing process in value stream map

Example of the same process represented using Possession, Ownership and Availability concepts is illustrated in Fig. 2. Information from the value stream map, which cannot be represented using core POA concepts, is depicted by the UML Note

symbol; an example is the information that Supplier delivers on Tuesdays and Thursdays.

Activities in the POA model are instantaneous (have zero duration), therefore, in the POA model, start and end of each manufacturing operation must be represented explicitly. It is also necessary to explicitly represent the resources consumed and created by each activity, for example, the *Start Stamping* activity consumes the metal foil and creates the temporary “in-stamping” resource. The *Finish Stamping* activity consumes the “in-stamping” resource and produces the stamped widget.

While the operation symbol in the value stream map indicates how many workers (staff) are required for the operation, the well-formed POA model must be more precise. Labor in the POA model is an economic resource created by Worker agents and is related by the “usage” relationship to the start and to the end of each manufacturing operation. The repository *Labor (work day)* represents the total available time of the Workers, while the start and end of each manufacturing operation represent the actual value-adding time of the used Labor. The value stream map in Fig. 1 does not illustrate utilization of labor, in contrast to the POA model.

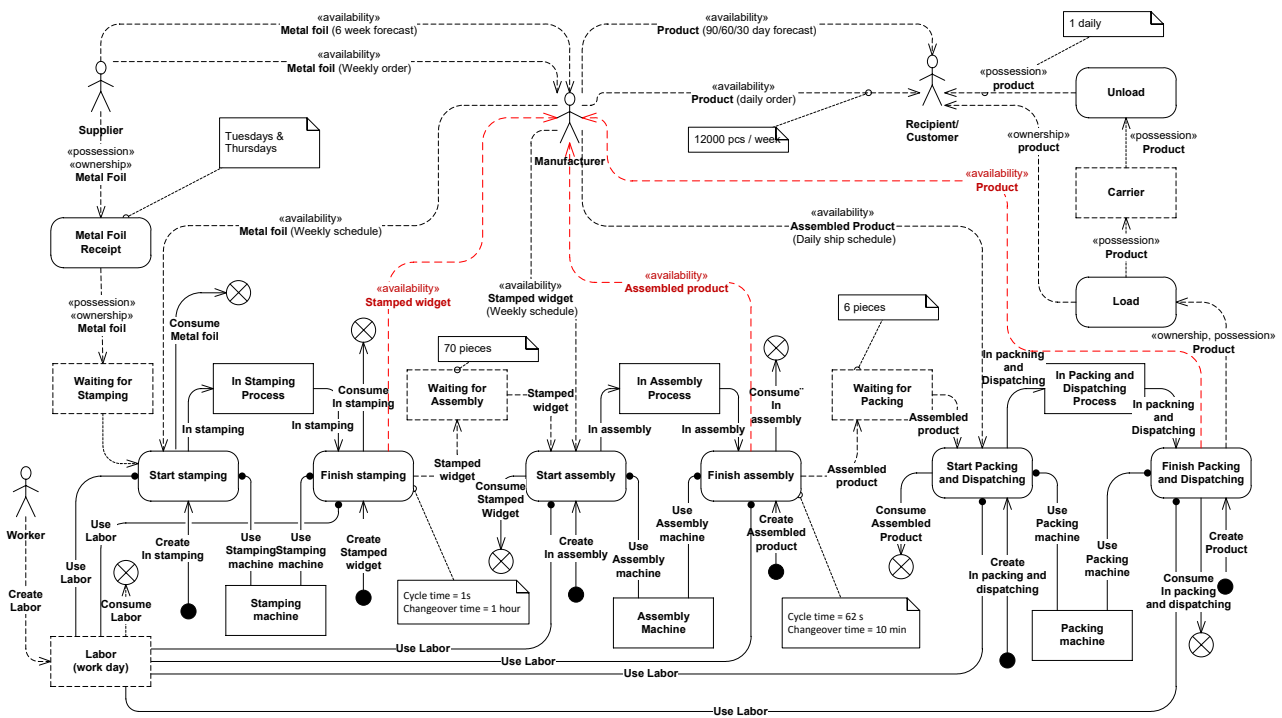


Fig. 2. Example of a manufacturing process using possession, ownership and availability

Another interesting observation is that the information flows (forecasts, weekly and daily orders), as well as the weekly and daily schedules in the value stream map in Fig. 1, are actually flows of availability of material, in the POA terms.

It illustrates the importance of determining the economic semantics of the information flows. The POA model has a consistency rule that when a resource is created, the possession, ownership and availability of this resource are created with it, likewise, possession, ownership and availability no longer exist after the resource is consumed. Therefore, an activity consuming a resource must have incoming flows of

possession, ownership and availability of this resource, otherwise the resource cannot be consumed.

Applying this rule leads to a discovery of flows not present in the VSM model in Fig. 1, but which are necessary for the completeness of the model from the economic perspective. For example, there must be a flow of availability of Stamped Widget resource to the Manufacturer, otherwise the Manufacturer would not be able to transfer this availability to Start Assembly activity, which needs it in order to consume Stamped Widget. The flows of resources discovered in this way are indicated in red color in Fig. 2.

During process improvement we can then start thinking whether this flow of availability must go through a central planning system or can be transferred directly to the next manufacturing operation, which could then start immediately after the previous operation finishes, which could in some cases lead to shorter waiting time and leaner process.

4 Information Model

The main purpose of the POA model is to create an enterprise information system, from the model of the flows of economic resources in the business ecosystem. Hruby and Scheller (2019) illustrated that occurrence of each flow at runtime represents an information that is useful to potentially all stakeholders in the ecosystem and can be forwarded to them. For example, the information about arrival of metal foil to the inventory can be also made available to the stamping, assembly, packing stations and perhaps even a Recipient/Consumer, which might get valuable signals about changes in the manufacturing processes. For example, when Samsung in 2016 stopped placing orders for components of 3D glasses, it was a useful signal for the consumers that Samsung is stopping producing 3D TV sets, although Samsung has not announced it publicly.

The number of information flows generated this way is proportional to the number of flows multiplied by the number of stakeholders; this amount of information in any larger system can no longer be handled manually and requires a digital solution.

5 Conclusions

Although the value stream map is an informal diagram, understanding the economic semantics of the material and information flows helps to make the process leaner and eliminate waste by discovering and enabling additional information flows between processes and trading partners, allowing them to adapt at runtime to the deviations from the schedules. Making the information instantly available where needed and when needed, requires a digital information technology solution.

Therefore, value stream mapping, in its traditional form, is a valuable tool in situations when digital information processing is not possible or desirable and when information must be fully or partially processed and transferred manually. If it is feasible to fully or partially automate the value stream and implement a digital information system, augmenting the value stream by possession, ownership and availability allows to design an information system better supporting the lean business processes.

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