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Improving performance in cataloguing and technical services workflows

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Introduction

Libraries are operating within what is currently a challenging economic climate. This looks set to continue for some years. This impact is being felt across the public and private sectors. Within the HE sector it is clear that further potentially far-reaching and possibly devastating funding cuts will happen. Universities have already made cuts which have impacted libraries in terms of staffing, services, information resources, opening hours, development plans and other ways. Challenging library budgets have lead libraries to consider the ways in which they operate at a process level. Focus is on doing more with less and in improving performance within, or with reduced, resources.

This article describes how specific process improvement tools and techniques can be used to improve cataloguing and technical services workflows. It derives, in part, from practical experience of conduction a process review in this area within an academic research library context. The discussion is then applied at the level of bibliographic description, analysing how process improvement can be applied to the Functional Requirement for Bibliographic Records .

Context

In the academic year 2007/8 the University of Warwick commenced an initiative of process improvement across a range of departments and activities. To do this the University engaged the services of Processfix, a company specialising in rapid improvement. An initially small number of improvement workshops took place across the University. Central to this work was Warwick Business School where improvement techniques and approaches have been adopted under the mantle of 'operational excellence'. The tools and techniques used by Processfix, and applied at the University, are derived, in a non-dogmatic manner, from established process improvement approaches, including Six Sigma and Lean and the combination thereof.

The University of Warwick Library began its work with process improvement in late 2008 when an initial workshop, focussed on the shelving of returned materials, took place. This was followed in January 2009 with a workshop on the acquisitions and cataloguing process for purchased monographic materials.[1]

This acquisitions and cataloguing workshop of January 2009 will serve as a starting point for the discussion that follows and will enable the focussing at the macro level of technical services activities. From this point, the discussion will then apply the analysis at the micro level of record creation. The discussion will move towards suggestions for workflow re-design based upon the outcomes of this analysis.

There is very little research that has been undertaken that applies process improvement techniques to cataloguing and/or metadata creation workflows. However, there are related areas which can provide useful insights or inputs into these discussions. The analysis of cataloguing backlogs, or arrearages, provides some useful insights into workflow management techniques. Similarly discussions of quality raise important issues that can help inform the debate.

Process improvement tools and techniques have been developed out of the manufacturing, rather than service, industries. Their application has often been focussed on the production of particular products. However, there has been a move towards the use of these tools within the service sector. Libraries are, for the most part, service rather than manufacturing-oriented.

The improvement workshop

The process improvement workshop takes the participants from the 'as-is' process to the 'to-be' process. In order to focus on a specific outcome a SMART objectives statement can be used, e.g. to reduce the time taken in the acquisitions and cataloguing process from the date of order to the date of availability to 25 days.

Participants analyse their current performance, identify issues, weaknesses, and problem areas. The 'as-is' process is scoped, mapped and analysed and specific improvement tools and techniques are introduced.

Following this, brainstorming can help participants to come up with improvements to the process. A future state, 'to-be' process is then mapped. The outcome of this is an action plan against which responsibilities for specific actions or tasks and time-frames are set. Participants agree to the action plan and are responsible for their allocated tasks. In a rapid improvement workshop relatively tight timescales are allocated.

Selected improvement tools and techniques

The following represent a small selection of some of the tools that might be used in the improvement workshop. All are openly available for public use and are derived from Lean and Six Sigma[2]

SIPOC

A key Six Sigma tool for establishing an overview of the process to be analysed. SIPOC stands for Suppliers-Inputs-Process-Outputs-Customers. A SIPOC enables the scoping of a process, and makes it possible to define what is in or out of scope for the project. This enables those involved in the improvement to remain focussed on those elements within the boundaries of the project. In the service sector it is important to note that the customers are the same as the suppliers, e.g. an academic member of staff requests a book for purchase and is the user of that book.

Suppliers	Inputs	Process	Outputs	Customers
Library users Library staff Innovative Interfaces Publishers Suppliers OCLC RLUK University Materials suppliers (3M, etc) Library of Congress	Orders Suppliers databases Publishers catalogues Bibliographic records AACR2 Classification schedules NAF LCSH Library funds Spine labels Library stamps Tattle tape RFID tags ILS IT equipment etc	Ordering books (etc) Receipting Checking & paying invoices Labelling Cataloguing Classifying Subject indexing Management reporting	Books (etc) Bibliographic records Authority records Payments Management information	Library users Library staff Suppliers OCLC RLUK Suppliers University

Figure 1. SIPOC

CTX/CTS tree

Another tool from Six Sigma, the CTX tree, where X is critical to whatever matters. The tool may also be used to refer to a specific outcome, where the value X is defined. This is the case with the Processfix approach used at the University of Warwick, where the tool is used as a CTS, or critical to success, tree. The CTS tree enables the identification of those factors that are essential to a successful process. It is possible to create multiple CTS trees to reflect the different customers of a particular process. In the acquisitions and cataloguing process the customers will include library users, library staff, as well as specific library departments or teams involved in the process who are customers of each other. At the micro level the individual metadata librarian is a customer of the procurement team as well as of OCLC or RLUK as record suppliers, LC as supplier of Classification Web, LCSH, and either OCLC or LC as suppliers of LC authority files. The CTS tree enables the identification of these critical factors to being specific and measurable. Generically the factors of time, quality, and quantity can be used as drivers for a specific need. The aim is to identify the measurable parts of these drivers. Thus each factor needs to be broken down to measurable parts. A CTS tree can, then, be used to identify key performance indicators (KPIs). At the macro-level of the acquisitions and cataloguing process, the library user wants to have a specific book available. The drivers of

timeliness, quality, and quantity can be measured by, respectively, the speed with which the book is available, the right book being available at the right time, and there being an adequate number of copies to meet customer demand. At the micro-level the metadata librarian will produce a record in a timely manner with the correct descriptive content and controlled access points, conforming to appropriate standards, which will be adequate to meet user tasks for resource discovery.
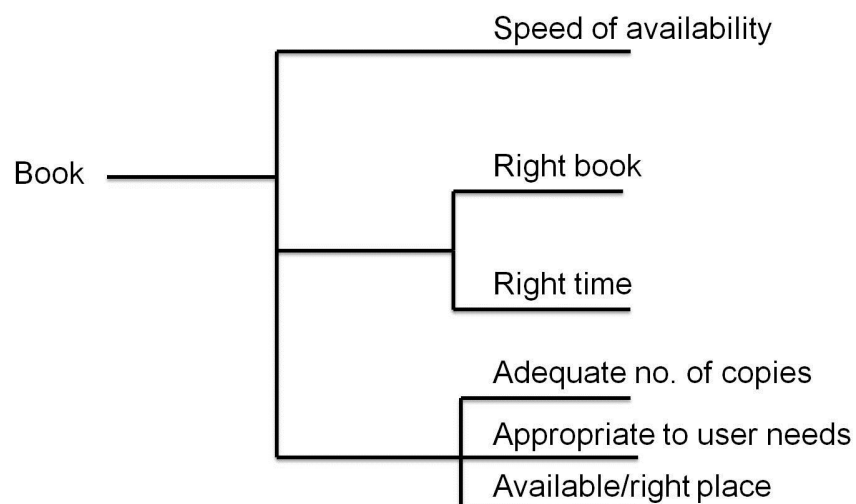
Figure 2. CTX/CTS tree

Process map
A process map is a flow chart. It represents the sequence of activities within the process. A process map needs to be created with all stakeholders involved in the process. It is then possible to establish a full representation of the overall process. It is a tool not confined to a single process improvement technique but is widely used independent of methodology. Using the SIPOC it has been possible to define the end-to-end process. The process map takes these beginning and end points and records each stage in the process between these two points. The process map can be enhanced with the use of 'swim lanes' which can highlight functional areas that participate in the process. In the acquisitions and cataloguing process map includes swim lanes for the procurement and the metadata functions. At the micro level of the metadata librarian there could be swim lanes for descriptive cataloguing, classification, subject indexing, etc. Using the swim lanes it is possible to visually represent the hand-over between one function and another. Hand-over and re-work loops can introduce waste into the process.

7 wastes
Taiichi Ohno identified the 7 wastes that are a cornerstone of Lean in the 'Toyota production system' and are referred to by the Japanese 'muda'[3]. Wastes are defined as something that does not add value to a process or for which the customer is not prepared to pay. Whilst based in the manufacturing, as opposed to the service, sector this tool can be applied within the library, and any service, context. Ohno's 7 wastes are: Waiting time; transport; component design; inventory (or WIP in a service context); over production; motion; defective goods. It is important to note that no process will be devoid of waste. In the acquisitions and cataloguing workflow a large amount of waste could be identified. There was waiting time whilst orders were waiting to be received. There was an amount of transport as stock was physically moved around from department to department. (The amount of transport involved in the process could be measured with a string diagram based on a scale floor-plan). The ways in which information was recorded could be modified through a revised component design. WIP was represented by backlogs/arrearages. Over production was seen in the

recording of the same piece of information multiple times, for example in the ILS and on paper. Motion was present in the repeated handling of stock such as taking it on and off trolleys, to and from desks, at particular stages in the workflow. Defective goods were present in the form of either incorrect titles or incorrect bibliographic records. The 7 wastes can complement the process map, giving clues to the identification of wasteful activities and increasing overall cycle time.

Process efficiency

Can be used to assess performance and establish benchmarking data from which to measure improvement. The focus is on non-value adding activities in order to eliminate, reduce, or optimise them. Process efficiency is defined mathematically as: value-added time ÷ activity cycle time x 100. What is measured is secondary to how (i.e. how consistently) it is measured – to ensure accurate measurement of before & after processes. Process efficiency in acquisitions & cataloguing context would be: time spent on cat/class/subject indexing ÷ time through whole process of acquisition to shelf x 100. At the micro level this can be calculated by the time spent amending a bibliographic record ÷ total time cataloguing and classification (e.g. verifying headings in the authority file, etc.) x 100.

WIP

WIP is unfinished work at any stage in the process at specific point in time. Cataloguing departments regularly experience WIP in the form of backlogs/arrearages. The amount and volume of WIP at the different stages of a process can be used to identify bottlenecks, either real or potential. There will always be WIP if a process is unbalanced and one stage works slower than another. A process with no WIP is indicative of over-capacity and underutilised resource. Inversely, a process with under-capacity will experience an increase in WIP as the process runs. The professional library literature on backlogs provides a good insight into WIP in the acquisitions and cataloguing workflow. There is a view that any backlog indicates that a cataloguing department is either under-performing or is lacking capacity. However, it has also been suggested that WIP, in the form of backlogs, can be used to even-out the acquisitions/cataloguing process, smoothing over the unbalanced yearly cycle. In the acquisitions/cataloguing workflow it is clear what WIP is at it can be identified by either pending orders or received orders in the form of physical items. At the micro level, in addition to individual workloads, WIP may occur for the metadata librarian as incomplete work, where elements that make up the bibliographic record are lacking or incomplete. Records awaiting LCSH, classmarks, authority control, may constitute WIP. This is dependent upon how the individual chooses to work.

Pareto chart

This can be created using time-based data for how long a particular activity takes within a workflow, i.e. how long a single stage takes in comparison to others. The Pareto principle rule developed by Italian economist Vilfredo Pareto is better known as the 80/20[4]. Constructed as a bar-chart, it can be used to identify WIP and level activities within a process. It is sometimes assumed that, when activities identified in the Pareto chart that demand the largest proportion of time that the solution is to allocate more resource to that activity. This is not necessarily the case as it will push the WIP to the next most time-consuming stage. The key is to balance the activities. The Pareto chart is a very useful tool to help identify which activities need balancing in relation to others. At the macro level in the acquisitions/cataloguing process it helped identify the blockages in the process. At the micro level it can be used to examine the steps in creating a record (descriptive elements, headings, classification, subject headings).
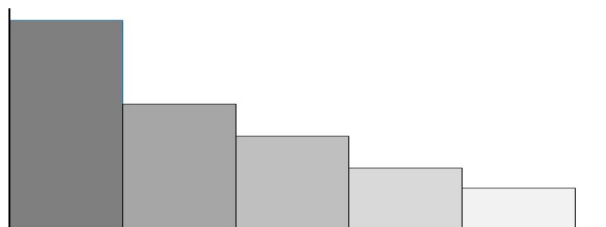
Figure 3. Pareto chart

Applying improvement tools to FRBR user tasks

Functional Requirements for Bibliographic Records (FRBR), chapter 6 is titled "user tasks". This chapter identifies which attributes and relationships are important for the FRBR group 1 entities of work, expression, manifestation, and item relative to the specific user tasks of find, identify, select, and obtain and ranks them according to high/medium/low value[5].

The attributes and relationships of an entity complement each other. Chapter 6 aims to "indicate the relative value of each attribute or relationship in supporting a specific user task focused on a particular entity[6]." This is done by mapping entity attributes and relationships to the user tasks. Chapter 6 lists the attributes and relationships associated with each of the group 1 entities. It plots the four user tasks against each attribute and relationship. Each task is then "broken out into four sub-tasks in relation to the entity on which the task is focused (i.e., find *work*, find *expression*, find *manifestation*, find *item*, identify *work*, identify *expression*[7], etc.)." Thus, to support a particular user task, both the attribute and relationships between the entity and other entities may be important[8]. Relationships allow the user to associate an entity with another entity or, to use FRBR language, to "navigate" a bibliographic database. FRBR states, "In a sense "relate" could be viewed as a fifth user task.[9]"

This analysis makes it possible, within the bibliographic record, to identify which attributes are being used to perform a particular user task for an individual group 1 entity. The bibliographic record can be examined for this content. Thus it is possible to identify specific data elements and why they are applied.

The FRBR analysis breaks open the bibliographic record in such a way that allows process improvement tools to be applied. Having exposed the attributes and relationships of group 1 entities in relation to the user tasks and sub-tasks, they can be measured within the workflow. This can enable the understanding, for example, of the proportion of resource expenditure involved in the recording of specific attributes and relationships within the process. This can be applied to either the current flat data structure of the single record or to the hierarchical, multiple record model that FRBR supports.

The task is, then, to apply process improvement tools and techniques to the entity relationship model of FRBR. This will enable an analysis of the specific entities and relationships that facilitate the user tasks within the context of their resource requirements. The extent of resource expenditure on recording the entity and/or relationships can be set against that of other entities and relationships. This can be done generically against the bibliographic record in relation to the user tasks but can also be applied against specific identified criteria within the context of required input standards.

FRBR record requirements

Chapter seven of FRBR is concerned with the "basic requirements for national bibliographic records", and makes recommendations for basic levels of functionality. It identifies which elements should be present for a basic record[10]. This is based on the identifying of entities and relationships in chapter 6 and identifies the specific data elements needed to enable the user to achieve specific tasks[11]. These requirements FRBR arranges into their descriptive and organising elements.

From chapter seven it is possible to identify which group one entities and attributes are deemed most important for record content to achieve specific user tasks. This drives cataloguing to meet these

requirements. It then becomes possible to structure work and/or the cataloguing department in order to meet these requirements. Thus FRBR leads back to the analysis of workflows considering how work is done, what is prioritised, included or, conversely, excluded from the individual record. FRBR serves as base-line data on which to base the workflow. By identifying requirements FRBR states what is important. The logical response to this is to question how this can be achieved and how work can be organised to meet these needs. In process terms, this, in effect, gives a 'to-be' process to work towards. Using the improvement tools and baseline data gathered work can then be re-structured. Specific entities and relationships are identified as required. It is then the task of allocating resource to not only meet these requirements but to balance the activities that enable them. Thus the FRBR analysis can help in two ways: firstly, in identifying which elements need to be present within the bibliographic record and, secondly; in organising workflow in order to achieve these aims[12].

Conclusions

Process reviews can make significant changes to the work of technical services and cataloguing departments. Employing specific improvement tools and techniques to analyse workflows and make alterations to those workflows can improve overall efficiency. It may be that, most often, libraries wish to increase the speed of performance in these areas, for example in acquisitions and cataloguing of new materials.

Utilising tools such as a SIPOC in conjunction with a process map makes it possible to gain a clear understanding of what is in, and outside of, scope within a process and in the individual activities of which it is comprised. This also helps identify backlogs, or work-in-progress, within the process. It is then possible to establish for process efficiency.

It has also been illustrated that it is possible to these improvement tools further, using them to bring an understanding of the balance between descriptive and organising elements within bibliographic records and in their utility relative to the FRBR user tasks. The application of specific improvement tools can help bring about changes to cataloguing practices.

CTS trees can be created for the each of the FRBR user tasks, identifying the critical factors for the user to find, identify, select and obtain for each FRBR group 1 entity. This will influence which descriptive and organising elements are present in the bibliographic record. Similarly, through the identification of waste, any activity that does not enable the FRBR user tasks can be seen as adding waste into the process.

The Pareto chart can illustrate how much time is spent in creating metadata for works, expressions, manifestations, and items, either in a single record or in separate records, as well as how much time is spent relative to enabling the specific user tasks. Whether analysing workflows at the macro or micro level, or at both, the focus should be on process improvement; what can be improved, by how much, and where improvements should take place.

References

1. Subsequently, in order to maximise its investment in operational excellence, a group of University staff has been trained as business process review facilitators.
2. For example see: Lean Six Sigma for Dummies / John Morgan & Martin Bering-Jones. Chichester: Wiley, 2009. Six Sigma for Dummies / Craig   Gygi et al. Chichester : Wiley, 2005.
3. Toyota production system : beyond large-scale production / Taiichi Ohno. Portland, OR : Productivity Press, 1988.
4. Manual of political economy / Vilfredo Pareto translated by Ann S. Schwier and Alfred N. Page. London : Macmillan, 1972.
5. op cit. tables 6.1 – 6.4
6. ibid p.80
7. ibid pp.79-80
8. ibid p.80
9. ibid
10. ibid tables 7.1 – 7.9
11. ibid pp.93-94
12. This analysis of FRBR could also be used in catalogue design, using the high/medium/low values as primary and secondary searching and/or qualifying options within the catalogue interface.