

**Waterfall method: a necessary tool for implementing library projects**

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**Abstract**

This paper describes a methodology for implementing effectively library projects. The authors explain how the Waterfall Method for information system development and organizational design, created by Winston W. Royce can be applied to library projects. The proposed adaptation of the method for library projects is presented in stages; where each stage has a set of activities that produce deliverables that serve as evidence documentation for management or governing agencies. The stages are given a percentage to establish relevance and a basis to inform progress to top management. The benefits of applying the Waterfall Methodology include maintaining the scope of a project within the requirements and needs of all stakeholders; establishing cost control and time management for all the required activities; and provide documented evidence of the activities that govern the project. . It can be applied to every project and discipline, including education. The technique itself is so flexible that it could be used to manage research proposals, investigations, and even operational plans, but as in library sciences, the lack of information in the educational area present some challenges to this method followers

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## **Introduction**

The purpose of this paper is to propose a methodology for implementing effectively library projects. The primary emphasis of the methodology is to provide a project management strategy that will fit most library projects. The basis of the methodology will be based on the Waterfall Method for information system development and organizational design, created by Winston W. Royce in 1970 (Royce, 1970, p. 328).

Today, librarians implement better services for providing resources through the internet and on-site physically to their users. In traditional and digital libraries, services include access to informational resources like books, journals, magazines, videos, audio media, maps and historical archives (Digital Libraries, 2003). Also, services like electronic reference, e-reserves and electronic interlibrary loans are becoming increasingly implemented by libraries. Furthermore, the need to market those services and resources has turned them to social networks by using Web 2.0 tools for help.

Libraries can manage the implementation of new procedures and projects by using project management methodologies. According to Winston and Hoffman (2005) project management methods can help libraries administrators to ensure the most efficient and effective use of resources and the completion of projects (p. 60). The completion of project activities requires a series of different and diverse skills, and having a structured methodology is necessary for setting the project environment (Cerrone, 2007, p. 23).

This paper will describe the Waterfall Methodology for information system development in terms of organization design, and its use in project management. After examining this

methodology, we then propose a library project management strategy based on the Waterfall Methodology.

### **Waterfall Methodology for Information Systems Development**

The design of an information or computer system requires considerable organization and management; a planned approach needs to be taken to define how the development and implementation needs to be performed ('Systems design and life cycle', 2008). Winston and Hoffman (2005) explain the Waterfall Methodology applies the principle that the development process should be divided into phases to provide clarity of content. Results of each phase are documented and the next phase only begins when all pre-requisites are satisfied. It is not permitted to return to a previous phase, once another has started unless the implementation requirements change. The project is completed when all phase gate reviews are satisfied. Requirements change must be tracked and controlled so as to reduce scope creep.

The phases for a development of a system using the Waterfall Method are typically as follows (Systems design and life cycle, 2008):

1. Feasibility study: benefits, cost estimates, effectiveness from a new or improved system need to be determined.
2. System requirements: existing system is analyzed and requirement specifications from the system owner are gathered.
3. System design: involves the technical specification produced for the new system based on requirements.

4. Design Implementation: work begins on the development or production of the new or improved system.
5. Testing and Installation: protocols for testing verification and proper installation are performed.
6. Maintenance: after the system is implemented, operational modifications could be made to fit new requirements.

The successful implementation of an information systems project or any other project will be based on answering effectively the following questions:

*Is the system acceptable to the customer?*

*Was it delivered according to schedule?*

*Did the project ended within the agreed budget?*

*Did the system development process have a minimal impact on ongoing operations?*

### **Why use the Waterfall Method instead of other methods for Library Projects**

According to Cerrone (2007), the *Project Management Body of Knowledge* (PMBOK) developed by the Project Management Institute approximately 20 years ago, is the definitive methodology for theory and practice. Adherence to the PMBOK method assures a successful implementation. The PMBOK method establishes that during the course of a project, activities occur within the following five process groups:

1. Initiating processes which focus on gaining authorization of a project or one of its phases.
2. Planning processes that define objectives and select courses of action that will be used to effect project goals.

3. Executing processes used to coordinate activities, staff, and other resources in order to put the plan into action.
4. Controlling processes which provide the context for measurement and monitoring of project results in order to prevent variance from the plan or correct the course of action when a variance occurs.
5. Closing processes that formalize the acceptance of the project and end the project activities.

The detailed activities that fall within the five process groups are 44 different in total.

Furthermore, detailed tasks can be applied differently depending on the objective.

The biggest difference between PMBOK and the Waterfall method is complexity. PMBOK is better suited for large scale projects and requires experience and the ability to apply specific activities to diverse processes in order to manage the project efficiently (Cervone, 2007). On the other hand, the Waterfall Method is simple and convenient while allowing the flexibility for managing both, large scale and small scale projects.

Oura and Kijima (2001) explain that the waterfall method is employed top down in the sense that the development process can only proceed if management approves each phase. This could be an issue if the organization is a bottom-up and changes come from lower level personnel. The simple process that the Waterfall method provides makes it ideal for libraries project management.

### **Waterfall Method for Library Project Management**

The Waterfall Method divides the development process by phases. The proposed adaptation of the method for library projects will be presented in the following stages: plan, design, implementation and operations. Each stage has a set of activities that produce deliverables that serve as evidence documentation for management or governing agencies. The stages are given a percentage to establish relevance and a basis to inform progress to upper management.

In the Plan Stage, the scope of the library's project is discussed and analyzed. There is a need to establish the project feasibility, user requirements, map the current process, establish the team charter and get the buying from management. This stage corresponds to the Feasibility Phase and Requirements Specification described in the Waterfall Methodology.

**Table 1**

**Activities and Deliverables during the Planning Phase**

<b>Phase</b>	<b>No.</b>	<b>Activity</b>	<b>Team Outputs / Deliverables from Process</b>
<b>PLAN (15%)</b>	1	Define the scope of the project with management	(1) Copy of Project Scope Meeting Minutes (2) Copy of Presentation to Management
	2	Kick Off Meeting	(1) Kick Off Presentation, (2) Meeting Minutes
	3	Team Charter	(1) Copy of Team Charter
	4	Identify Library Systems Project Drivers or Agencies Observations to the System	(1) List of Related Business Issues or Project Drivers (2) Meeting Minutes
	5	Develop "As-Is" Process Map	(1) Copy of "As-Is" Process Map
	6	Develop High Level "To-Be" Process Map	(1) Copy of High-Level "To-Be" Process Map if Necessary to Show Alternatives

Phase	No.	Activity	Team Outputs / Deliverables from Process
	8	Determine Alternative Approaches	(1) List with Pros, Cons and Recommendation; (2) Meeting Minutes
	9	Identify Communication Needs	(1) List of Stakeholders vs Communication Approach
	11	Phase Gate Review to Management	(1) Copy of Meeting Minutes Indicating Approval if Required

In the Design Stage, specifications described in the user requirements to be processed are designed. The library systems procedures or guidelines, communication plan with end users and measurements that will show improvement are developed. This stage corresponds with the design phase in the Waterfall Methodology.

**Table 2**

**Activities and deliverables during the Design Phase**

Phase	No.	Activity	Team Outputs / Deliverables from Process
<b>DESIGN (50%)</b>	12	Prepare Detailed “To-Be” Process Map	(1) Copy of Detailed “To-Be” Process Map
	13	Acquire possible software/or hardware system (if applicable)	(1) Copy of requisition or Purchase Order
	14	Prepare New, Revised or Delete Procedures	(1) Copy of Existing Procedures, (2) Copy of Draft Procedures
	15	Prepare Training Materials, Identify Trainees & Trainers	(1) Copy of Approved Training Materials, (b) List of Trainers, (2) List of Trainees

Phase	No.	Activity	Team Outputs / Deliverables from Process
	16	Prepare Communication Plan	(1) Copy Plan
	17	Develop Effectiveness Measures	(1) List of Identified Measures that will Show Improvement, (2) Baseline Data
	18	Phase Gate Review to Management	(1) Copy of Meeting Minutes Indicating Approval if Required

The Implementation Stage requires the library system to be installed or commissioned for testing by end user. The end user is then presented with the procedures and training developed for them to test the system. This stage comprises the implementation of design, testing and installation in the Waterfall Methodology.

**Table 3**

**Activities and deliverables during the Implementation Phase**

Phase	No.	Activity	Team Outputs / Deliverables from Process
<b>IMPLEMENTATION (25%)</b>	19	Deliver Communication	(1) Copy of Communication Presentations, (2) Copy of Minutes
	20	Approve Procedures	(1) Copy of Approved Procedures
	21	Deliver Training	(1) Copy of Training Records vs. Required Participants
	22	Install or Commission Library System Infrastructure	(1) Copy of library system Infrastructure Implementation Documentation
	23	Implement Effectiveness Measures	(1) Copy of Approved Metrics Implementation Methodology



Phase	No.	Activity	Team Outputs / Deliverables from Process
	24	Phase Gate Review to Management	(1) Copy of Meeting Minutes Indicating Approval if Required

The Operation Stage refers to the formal use by library system's end user. The library system needs to be monitored for ensuring compliance with requirements specification. Provide a presentation to management to close the project and archive documentation for evidence. This stage is more comprehensive than the Waterfall Methodology as it comprises system compliance and operation and maintenance.

**Table 4**

**Activities and deliverables during the Operations Phase**

Phase	No.	Activity	Team Outputs / Deliverables from Process
<b>OPERATION (10%)</b>	24	Monitor Effectiveness Measures	(1) Copy of Trend and Analysis Reports, (2) Response to Trends if Necessary
	25	Conduct a Systems Audit	(1) Copy of Audit Report that Evaluates Output Documents of Improved System
	26	Provide a Presentation to Management	(1) Copy of Presentation
	27	Archive Project Documents and Decommission Team	(1) Archive in Specified Location in Library Archive

As we can see, the Waterfall method is very simple. It can be applied to every project and discipline, including education. The technique itself is so flexible that it could be used to manage

research proposals, investigations, and even operational plans, but as in library sciences, the lack of information in the educational area present some challenges to this method followers.

Koskela and Howell (2002) present that:

The lack of theory has rendered education and training more difficult and has hampered effective professionalization of project management. Lacking theory, project management cannot claim, and will not be granted a permanent and respected place in higher education institutions. Also, the lack of an explanation of project management, to be provided by a theory, has slowed down the diffusion of project management methods in practice (p. 12).

There is a vast amount of information of project management methods, especially in the areas of engineering, software development, construction, architecture and telecommunications. Project management itself has been transformed through the decades by these disciplines, but the application of project management methods are more used in the industry by practitioners, rather than by educators (Hoon-Kwak & Ambari, 2009; Koskela & Howell, 2002). This presents a dichotomy between practice and scholarship because practitioners are using project management methods on a daily basis but higher education institutions are not using it as much as we expect. Further research and analysis has to be done in order to establish why scholars are not taking advantage of project management methods in the academy.

## **Conclusions**

The present paper proposed the application of the Waterfall Methodology to library projects. Library and information science professionals could implement this staged based approach to their projects.

The benefits of applying the Waterfall Methodology in libraries can help administrators to: 1) maintain the scope of a project within the requirements and needs of all stakeholders; 2) establish cost control and time management for all the activities required; and 3) obtain documented evidence of the activities that govern projects. The literature review shows that there was no research publications identified that applied the Waterfall Methodology to Library projects and education. Future research can be performed using the methodology and applying it to a specific library or educational project.

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