CAPM Chapter 1:
An Introduction to the Project Management Body of Knowledge

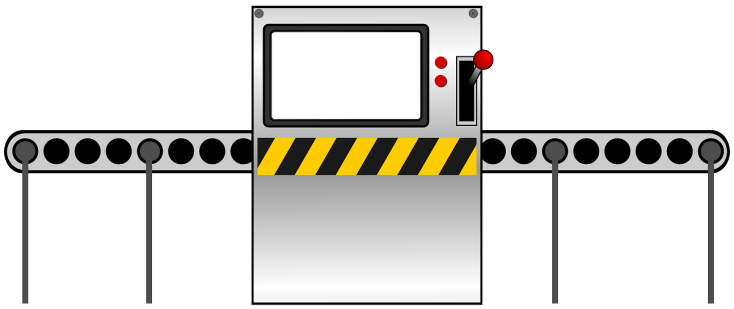

***Figure 1*. Simplified production line (OpenClipart-Vectors, 2013).**

Judy Wong is a project manager at Waterloo Automotive Components which manufactures and supplies parts to major car manufacturers in Southern Ontario. Plans have been created for major updates to the production line that makes brake pads, which incorporate new technologies in the product itself and in the production process. The work on the project will involve many aspects. New equipment will need to be sourced and installed, some existing equipment will need to be modified, employees will need to be trained and support services, such as line maintenance, will need to be set up for the updated line. All of these tasks need to be completed within a limited timeframe so that the company can supply its customers with the new pads in order to meet their production requirements.

Judy is responsible for making sure the project is completed so that the line will produce according to WAC's requirements, within the budget that has been established for the project and on the schedule that she has been given. Failure to meet any of these objectives could result in severe financial costs for WAC and have long term impact on the success of the business.

Projects often experience difficulties — putting all of the elements together to complete the project is very complicated and Judy wants to improve the probability that the project will be successful. Fortunately, she has been trained in the project management approach (or methodology) that has been created by the Project Management Institute, The Project Management Body of Knowledge (PMBOK), and has achieved the Project Management Professional designation. She will apply this methodology in the management of the project.

The Project Management Institute is the largest global organization of project managers. They provide a range of project management certifications which are based on their book, "A Guide to the Project Management Body of Knowledge". Often referred to as the PMBOK, this book provides guidance for project managers on how they should manage projects. Certification from the Project Management Institute is widely respected and often insisted upon by employers as a condition for consideration for project management jobs.

The PMI certification is respected globally. In many professions, certification is country specific (for example, accounting certification is specific to each country — to practice accounting in a country other than the one that your certification is for usually requires further training). PMI certification is globally transferrable — certification can be used to work in many countries.

The PMBOK describes the standard for managing projects. The standard is the accepted knowledge of practices that are generally thought to be effective in managing projects. The PMI understand that there is knowledge that is valuable in managing projects that is not contained within PMBOK. Knowledge is constantly evolving and some projects will need practices that are not found in PMBOK.

PMBOK says that it establishes norms, methods, processes and practices for managing projects. The content of the standard has been developed by project managers who have participated in consultative processes through the PMI, who say that it represents good practice on most projects most of the time. The phrase "most of the time" indicates that project managers are responsible for deciding on which parts of the PMBOK are relevant to their project and how they will be used.

The PMBOK has three parts. Part One has 13 chapters that describe the project management processes, Part Two describes the Standard for Project Management, and Part Three contains appendices, a glossary and index. The first two chapters provide background and key elements of the PMBOK. The third chapter describes the groups

that the project management processes are combined within and how they impact and interact with each other. Chapters 4 to 13 are the processes themselves. Details are provided of the inputs and outputs of the processes as well as tools and techniques that can be used to apply them. Chapter 1 of the PMBOK is intended to introduce readers to the guide itself. It describes the purpose of the guide and what projects and project management are. It introduces Portfolio Management, Program Management and Organizational Project management and explains the relationships between these areas and project management itself.

Chapter 1 also considers how project management, operations management and organizational strategy impact each other, examines how projects contribute to business value and discusses the project manager's role.

***Figure 2*. Various aspects of project management (mohamed_hassan, 2017).**

1.1. Overview and Purpose of the PMBOK Guide

The PMBOK Guide is based on the principle that there are good ways of managing projects and that understanding and applying the processes, tools and techniques, as well as the knowledge of effective project management are likely to increase the likelihood of project success. The PMBOK Guide is the Project Management Institute's view of how most projects should be managed most of the time. It is important to stress that they do not say that all projects will benefit from the PMBOK Guide all of the time. Some projects will be affected by events or factors that cannot be controlled or influenced by the project manager. Some projects also may not be suited to the methodology of the PMBOK Guide.

In stressing that not all projects will benefit from PMBOK, the PMI are making it clear that the responsibility for deciding on which processes from PMBOK will be applied to a project and the way in which they will be applied lies with the project manager. The Guide provides a selection of resources that the project manager can use — it is up to the project manager to decide whether, when and how to use them.

Project management, as with many other professions, has its own set of words and terms. These are listed in the PMI Lexicon of Project Management Terms which are included, along with other useful terms, in the glossary of the PMBOK.

Part Two of PMBOK describes the "standard" that the Project Management Institute have developed for managing a project. While PMBOK itself describes the processes, tools and techniques that can be used in projects, Part Two describes how they can be combined in different aspects of a project. It is intended to show one way of combining the processes, tools and techniques. Other combinations and processes are used for different methodologies, such as Agile, waterfall or Prince2 (all other methodologies for managing projects).

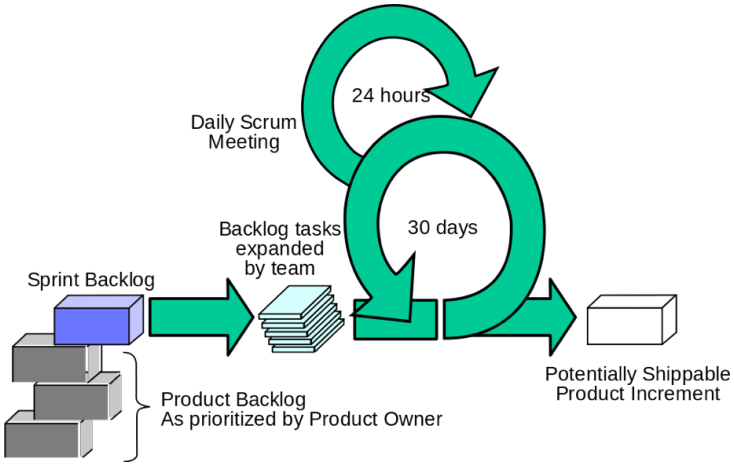

***Figure 3 (a)*. Flow-diagram describing the agile methodology (Marekventur, 2011).**

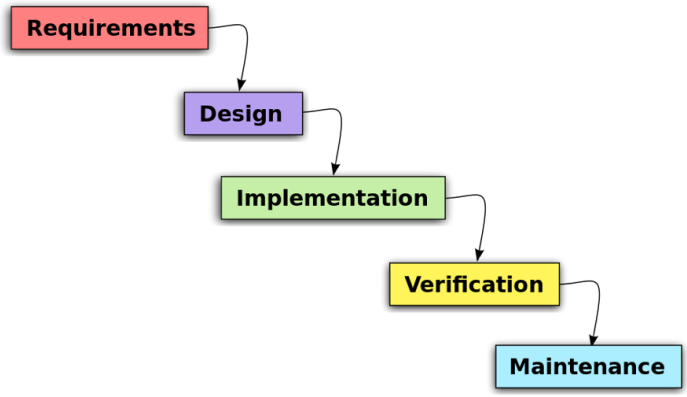

***Figure 3 (b)*. Flow-chart of a waterfall model (Beao & Smith, 2009).**

The PMI Code of Ethics and Professional Conduct describes how project practitioners should behave. PMI certification depends on adherence to the code. If you fail to apply the code you can be heavily penalised — including being reported to appropriate legal authorities and being disbarred from your project management certification. Knowledge of and adherence to the code are necessary for all PMI certification. You should study the code and apply it faithfully.

1.2. Foundational Elements

1.2.1. Projects

***Figure 1.1*. Comic describing an example of inefficient project management (Scott, 2002).**

Projects are distinguished from operations in the PMBOK. Projects have clear starts and finishes and are designed to achieve a specific, unique objective. Projects can be short or long and can end either when the objective has been achieved or whenever the client decides it is appropriate. This may also be when it is clear that the objectives cannot be met or when they are no longer desired. Judy's project at WAC is designed to update the production line. It will start when the WAC management team decides to undertake the project and end when brake pads start to be produced on the new line.

Work that an organization does on a repeatable basis is known as operational activity. The production of brake pads on the line is operations and not a project because this is the daily work that the organization does on a regular basis. Different approaches are used to managing operations in contrast with projects. Operational management is focused on regular repeatable activities whereas project management is focused on applying processes in unique circumstances that involve a higher degree of uncertainty. Projects usually involve more planning than operational activities which are repeating processes that have been used frequently in the past.

Projects can be used to create products, services, improvements to existing products or services and results — such as the findings of a research project. Projects can also be used to drive change in organizations, to move from their current state to a state that they desire to achieve in the future.

Projects are also used to provide value to organizations in many forms. They can create new assets (money, equipment, market share, etc.) which can be tangible and intangible. The context that a project is undertaken in will influence its objectives and how it may be conducted. Projects can be to meet statutory requirements (regulations, laws or other requirements), to meet stakeholder demands, to change company strategy or to improve products, processes or services.

***Figure 1.2*. Different aspects of project management are co-related and ultimately lead to success (geralt, 2016).**

WAC is a large company and undertakes several projects at the same time. A group of projects which are designed to go together achieve a set of strategic objectives are known as a portfolio. WAC have a collection of projects that are intended to modernize their manufacturing operations, including the introduction of a new enterprise resources planning system that will help them manage their manufacturing more effectively, construction of a new warehouse for their expanded product range, various renovations/upgrades of their manufacturing processes and installation of robotics equipment in some of their production operations. These projects together are known as a portfolio.

A collection of subsets of these projects that are intended to achieve elements of the portfolio is known as a program. Robotics projects in the brake pad line, the painting area and their welding processes are together known as a program.

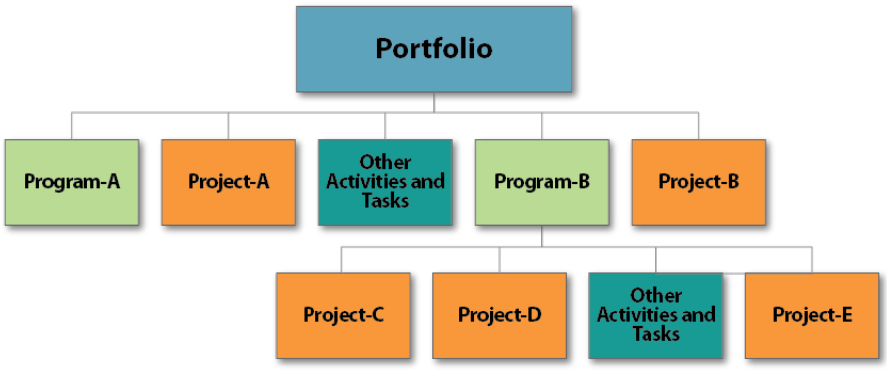

***Figure 1.3*. The relationship between a portfolio, programs, and projects.**

Organizations need to plan their allocation of resources to projects — they will only have limited resources for project activity and ensuring that it is allocated where provides the most benefit requires careful organizational planning.

1.2.2. The Importance of Project Management

Project management is defined by the PMBOK as:

> the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements.
>
> — PMBOK 6th edition p.10

Many organizations today face increasing pressure to change, to respond to rapidly changing markets, to new technologies and competitors, more quickly and on a larger scale than they have had to do in the past. Successful project management is becoming more strategically important to organizations.

1.2.3. Relationship of Project, Program, Portfolio, and Operations Management

Organizations undertake projects in pursuit of their strategic objectives. WAC are an automotive components manufacturer. Their strategic objectives are to deliver good quality products to their customers, on time and at an appropriate cost that will allow them to charge a price that will result in a healthy financial position. Their projects are designed to enable them to do this better and remain competitive with the other companies which offer similar products.

WAC's projects are all intended to contribute to these objectives. Their project portfolio management helps them pick and support the projects that will do this. Their program management coordinates similar projects so that they complement and are aligned with each other while their project management helps them successfully complete individual projects.

Their projects take place within the WAC organization structure, within their organizational culture, with access to their technology management practices. Organizational Project Management aligns the projects with these elements to make them more effective.

Many projects take place within an organizational environment, alongside other projects and within the conditions, practices and resources of the organization. While PMBOK is focused on individual project management, understanding the context that projects take place within and approaches that are taken to aligning multiple projects is important.

Program management is focused on the management of a group of projects that are designed to achieve a specific strategic objective. The implementation of the Enterprise Resources Planning System at WAC may involve purchase and installation of new computer systems, specification, installation and set up of new software and management of changes to working practices that are implemented to enable the new system to provide performance benefits. These three projects will be more effectively conducted if there is management activity to deal with the connections between the projects. This may include ensuring that resources that are used by more than one project are accessible and that conflicts over their scheduling are appropriately resolved, that WAC operations management is undertaken in ways that contribute to the success of the project and that any issues or changes in one project that impact another project are properly considered managed through an overall governance structure.

Portfolio management is management of projects that may not have connections with each other but which together will contribute to overall strategic objectives. Cost reduction projects in an organization may be undertaken when it has been decided that this is strategically important by the senior management team but may take place in many organizational areas. Cost reduction in the accounting department activities is usually separate from that in engineering, for example. The projects to reduce costs may be part of a portfolio to enable resources to be allocated between the projects that are being undertaken to achieve the greatest benefit and to ensure that the organizational impact of the cost reductions is managed.

Project portfolio management focuses on resource allocation and alignment of project activities with strategic priorities.

Operations management is the management of the day-to-day operational activities of the business. In WAC this will include the management of the production of automotive components (assembly, design, engineering, maintenance, purchasing, warehousing, scheduling, delivery, etc.). Projects will often be designed to support changes in the organization's operational activities, for example, the introduction of robotics at WAC.

Projects are temporary while operations are the continuing activities of the organization. Sometimes these overlap, particularly when the results of a project are handed over to the operations team. In WAC the robotics projects will include training and handing over responsibility for using the robots in operations — operations and project activities will overlap when this happens. Also, at the start of a project, operational resources (in the robotics case, the area of operations where the robotics are being installed) may become part of the project responsibility as the project is conducted. While project management is concerned with managing projects, operations management is concerned with managing operations and outside the scope of PMBOK. Operational stakeholders will often need to be managed as part of project activity. Production managers, line employees, office workers etc. may be impacted by conduct of the project and by its results and so should be carefully managed by the project team.

Project activity should normally be consistent with the strategic direction of the organization. The management of an organization is intended to direct organizational activity towards its strategic goals and project activity should also be aligned with the goals of the organization. If project activity is not consistent with organizational goals, the organization is likely not to support the project and project activity will be difficult. When organizational goals change during a project, the project will also need to change.

Some organizations are Project-Based. Their main activity is conducting projects. Engineering companies that mainly undertake engineering projects, construction companies that mainly manage construction projects and software developers that develop custom software for organizations are examples of organizations that mainly undertake projects.

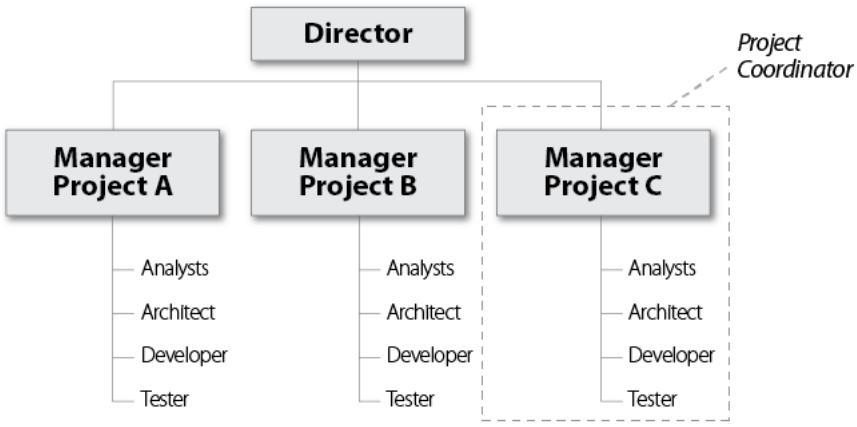

***Figure 1.4*. Layout example of a project-based company. © University of Waterloo.**

The alignment of projects with organizational strategic objectives is now often carefully controlled by organizations. Project managers of this type of how the project fits in the governance or management processes of the organization and take these into account when managing the project. For example, the robotics project may be influenced by agreements with employees on job changes that may influence how the robots will be deployed. The project activity will need to be consistent with these agreements.

Where a conflict is found to exist between the project objectives and organizational strategy, the project manager needs to resolve this with the organizational managers as soon as they can. Sometimes the project will influence change in organizational strategy as a result of its work. Better understanding of robotics that emerges from the WAC project may alter the approach that the organization takes to it.

1.2.4. Components of the Guide

A successful project combines many components that are effectively managed together. PMBOK is intended to help project managers achieve this effective combination.

Projects can be organized in a variety of ways, depending on the needs of the project and the preferences of the project manager or the organization. Usually, projects are completed in phases or sections which allow the project to be broken down into elements that are easier to manage. The Project Life Cycle is the combined series of phases that make up the whole project. The content of each phase can vary depending on the nature of the project, the organization that it is being conducted in and the project management methodology that is being used for the project.

Some projects place greater emphasis on the planning work that is undertaken at the beginning. A detailed plan is created which is intended to be followed throughout the project life cycle. This project methodology is known as predictive or plan-driven.

Other projects are harder to plan at the beginning. There is a higher degree of uncertainty about the work that will be done to meet the project objectives. Software projects often have an uncertain path — user needs may be better understood as the project proceeds and how each function of the software will be created may depend on work that is done in earlier project stages. It is very difficult to create a detailed plan for the project at the beginning. Projects of this type often use a methodology that adapts and modifies project activity regularly as the project proceeds. This methodology is more iterative — plans are developed for each phase after the previous phase has been completed. This project type is known as an adaptive life cycle project.

***Figure 1.5*. Example of a project life cycle (Leighblackall, 2014).**

While various project methodologies exist and projects themselves can be large or small, complex or simple, short or long, all projects have some basic elements in their life cycle. They have activities that occur at the beginning of the project and at end, they have the work that is done to organize and prepare to do the project work and they have the period in which the work is conducted to achieve the project objectives.

The common project aspects are part of the generic project life cycle — the elements that exist in all projects. This generic life cycle will also usually have some common characteristics. Project costs are usually low at the beginning, increase and peak while the work is being completed and decrease and stop as the project is completed. Not all projects will follow this pattern — some may have higher costs at the beginning if more planning is required, for example.

Risk is usually higher at the beginning of the project. As the project work is completed successfully, risks are eliminated. It is easier to influence the project at the beginning. As the project is completed it is harder to make changes to the project without incurring higher cost to make changes to work that has already been done.

Projects are often divided into more manageable phases. These phases are groupings of project activities that complete one or more project deliverables. In the WAC project one phase may include the work done to design production line changes and another might be the work to create the new line foundations. Other phases may complete other elements of the project.

The PMBOK groups project processes into five Process Groups: Initiating, Planning, Executing, Monitoring and Controlling, and Closing. Processes from all of these process groups may be used in each project phase. Different phases will involve different activities that require different resources to complete them. The design phase for WAC will require architects and designers while the foundations will require people with the appropriate engineering skills.

When phases are completed there is usually a transition to the next phase. At this time, work completed so far on the project may be reviewed and decisions made about changes to future work, including whether to proceed with the project — this point in the project is known as a Phase Gate and can also be known as a stage gate, milestone, phase review, or kill point.

The division of the project into phases will vary depending on the nature of the project and the preferences of the organizations or the project manager and team. The same project in different organizations may have very different phases. Not all projects will have multiple phases — some will only have one.

In projects with more than one phase, the relationship between the phases can be organized in a range of ways. In some projects, phases will be scheduled sequentially — each phase will start after the previous phase has been completed. Phases may also overlap — the next phase may start before the previous one has been completed.

This will increase project complexity which can increase the likelihood of problems but may also allow the project to be completed more quickly. Phases may be overlapped as part of fast tracking — used to speed a project up, particularly when there have been delays in the project schedule.

Predictive life cycle projects (those that are based on a detailed plan that has been created at the beginning of the project) will usually use sequential or overlapping project phases. The plans for the phases are developed at the beginning of the project and require completion of a formal change approval process. This approach is more commonly used where projects are more stable and predictable — at the beginning of the project there is confidence that most of the project activities will be able to be known and planned.

Iterative and Incremental life cycle projects repeat project phases, refining the project product repeatedly as the project proceeds. These projects may also use phases that are sequential or overlapping. Each phase will create an element of the project outcome. Client feedback on previous phases will be used to determine the work in subsequent phases. Once the criteria for each element of the project is completed, work will commence on the next.

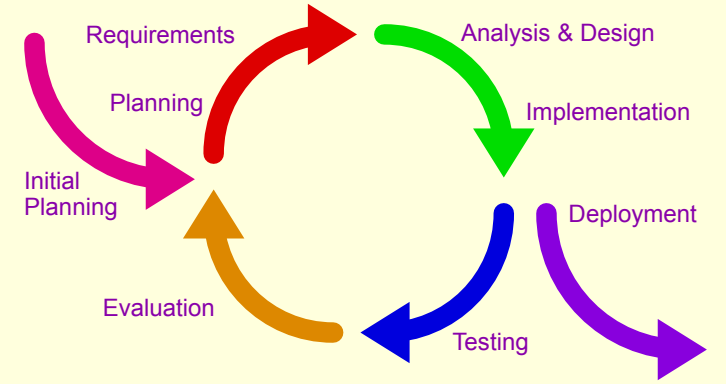

***Figure 1.6*. Iterative life cycles (Aflafla1, 2014).**

In these projects there is usually a very clear specification of the final project outcome but less certainty on how it will be achieved. Each phase of the project will be focused on an element of the outcome with detailed plans for each phase being created at the beginning of each phase. A high-level scope for each phase may be created at the beginning of the project to provide an outline plan for the project activity.

In adaptive life cycle projects (also known as agile projects), the emphasis is on being able to change project activity easily, based on stakeholder demands. These projects are also iterative but usually have very short phases (2 — 4 weeks). At the beginning of the project the client requirements are detailed on a product backlog list and each iteration completes one or more items from the list. The client reviews the deliverables of each iteration and provides feedback that is used in future project work. This type of project is usually used in environments where there is a higher level of change.

Project life cycles are managed using processes. The PMBOK groups the processes into Process Groups that allow project managers to select the processes for their project that they will use in their project. The groups are Initiating, Planning, Executing, Monitoring and Controlling and Closing.

The Initiating processes are used to start a project or a part of a project. Planning processes are used at the beginning of the project to start the project and may also be used to undertake planning as the project proceeds. Executing processes are used to carry out the project work and Monitoring and Controlling is used to observe project activity, assess whether it is achieving the project objectives and generate actions where these are needed. Closing processes are used at the end of the project or when elements of the project are completed.

While the processes are grouped into Process Groups they are also grouped into Knowledge Areas, which group processes by types of project activity. They are Project Integration Management, Project Scope Management, Project Schedule Management, Project Cost Management, Project Quality Management, Project Resource Management, Project Communications Management, Project Risk Management, Project Procurement Management and Project Stakeholder Management.

As the project proceeds, information is generated that informs future activity on the project. Executing processes provide information to assist the Monitoring and Controlling of the project and overall project decision making. Three terms are used to describe the information that is used in the project:

Work performance data: This is raw data, generated by project activity. It includes the amount of progress being made on an activity (for example the percentage of the old production line equipment that has been cleared from the work site), the dates that works has started and finished (for example, the line clearance started on July 24th and finished on October 11th). It is data that has not been interpreted or manipulated.

Work performance information: Data that has been analysed and integrated, which may include the status of the work being done (for example, an integrated report from the production line clearance might include the progress made on track clearance, fixture removal, oil tank drainage etc. — combining these elements in a report on production line clearance is described as work performance information).

Work performance reports: These are formal reports of information that are used to support project decisions. In the WAC project these might include a report on production line clearance that details the work that has been completed and recommends decisions based on this.

Use of the correct terminology is important in projects so that everyone understands the type of information that is being discussed and the purposes that it can be applied to.

1.2.5. Tailoring

The knowledge that is presented in the PMBOK is recommended as good practice to be used in projects most of the time. Project managers will approach their work on a project using a methodology, the way that they will organize the knowledge that they will bring to best managing the project. This methodology may come from PMBOK and The Standard for Project Management or from another methodology that is provided by their organization. Agile Project Management is another methodology.

The project manager will decide how the methodology that they are using will be applied in their project. They will select the processes that they will use (and the processes that they won't use), the tools and techniques that they will use from these processes and will decide on how the selections that they make will be combined with each other and adapted to the circumstances of their own particular project. Different project conditions, such as culture, organization size, market conditions etc., will influence the tailoring that is done by the project manager.

1.2.6. Project Management Business Documents

As Judy considers her project at WAC she is keen to ensure it will meet the needs of the business. She knows that updates to another area of the production line had been made in a previous project, that while being completed on time and on budget and installing the elements that had been discussed before the project started, was regarded as a failure because the performance of the production line was not improved. The Project Management Business Documents will help her ensure that her project is focused on the business objectives for it.

The project business documents provide the information that is needed to understand the needs of the business that the project is intended to achieve. There are two main documents:

The Project Business Case: Usually provided by the business sponsor and provides the financial justification for the project. It is often used to provide the initial justification for the project and to assess its success when it is complete. A detailed assessment of the business's needs is often undertaken to support the preparation of the business case.

The Project Benefits Management Plan: Describes how the benefits that are provided by the project will be achieved. There are many aspects of these benefits that may be important including the expected project tangible and intangible results, their effectiveness in contributing to the organization's strategy, how they will be measured, etc.

The project manager manages the alignment of the business case, the project activity and the benefits management plan. This will include tailoring project activity so that it best meets the objectives of the organization. The project charter and the project management plan should also be focused on achieving the business objectives of the project and will be influenced by the business documents.

Measuring a project has been a difficulty for many project managers. Establishing and maintaining measures that indicate the success that the project is having as it proceeds and enabling the identification of problems allows early addressing of problems before they become major issues. Time, cost, scope and quality have traditionally been the measures used but today there is increasing attention on measures that allow the progress towards the project business objectives to be understood.

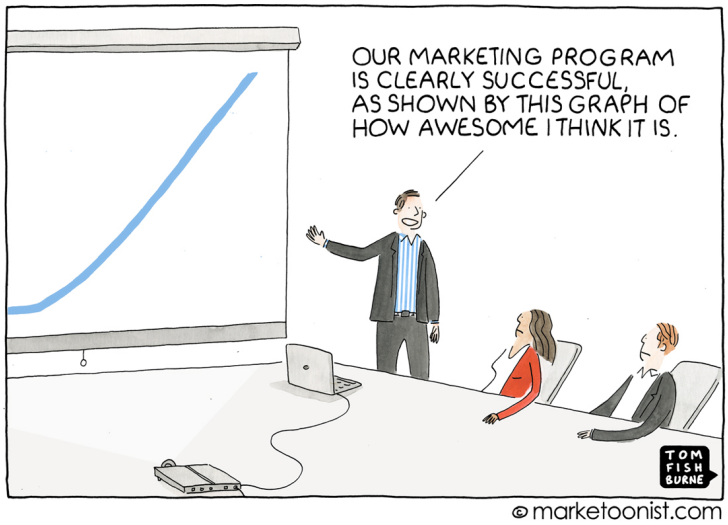

***Figure 1.7*. A comic example of the creative ways the success of a project may be measured (Fishburne, 2016).**

References

Adams, S. (2002, April 04). Thursday April 04, 2002. Retrieved March 22, 2018, from http://dilbert.com/strip/2002-04-04

Aflafla1. (2014, July 22). File:Iterative development model.svg. Retrieved March 22, 2018, from https://commons.wikimedia.org/wiki/File:Iterative_development_model.svg and licensed under CC0 1.0.

Beao, & Smith, P. (2009, September 17). File:Waterfall model revised.svg. Retrieved March 22, 2018, from https://commons.wikimedia.org/wiki/File:Waterfall_model_revised.svg and licensed under CC BY 3.0.

Fishburne, T. (2016, February 28). Marketing Vanity Metrics cartoon. Retrieved March 22, 2018, from https://marketoonist.com/2016/02/marketing-vanity-metrics.html

Geralt. (2016, January 13). Free Image on Pixabay - Business, Tree, Growth, Success. Retrieved March 22, 2018, from https://pixabay.com/en/business-tree-growth-success-team-1137367/ and licensed under CC0 1.0.

Leighblackall. (2014, June 30). File:Project Management Lifecycle. Retrieved March 22, 2018, from https://commons.wikimedia.org/wiki/File:Project_Management_Lifecycle.jpg and licensed under CC BY 3.0.

Marekventur. (2011, August 19). File:ScrumSchwaberBeedle.svg. Retrieved March 22, 2018, from https://commons.wikimedia.org/wiki/File:ScrumSchwaberBeedle.svg and licensed under CC BY-SA 3.0.

Mohamed_hassan. (2017, October). Free Image on Pixabay - Multi-Tasking, Efficiency, Manager. Retrieved March 22, 2018, from https://pixabay.com/en/multi-tasking-efficiency-manager-2840792/ and licensed under CC0 1.0.

OpenClipart-Vectors. (2013, October 15). Free Image on Pixabay - Factory, Machine, Assembly Line. Retrieved March 22, 2018, from https://pixabay.com/en/factory-machine-assembly-line-158423/ and licensed under CC0 1.0.