A Review of Project Management Methodologies used in Software Development and other IT Projects.

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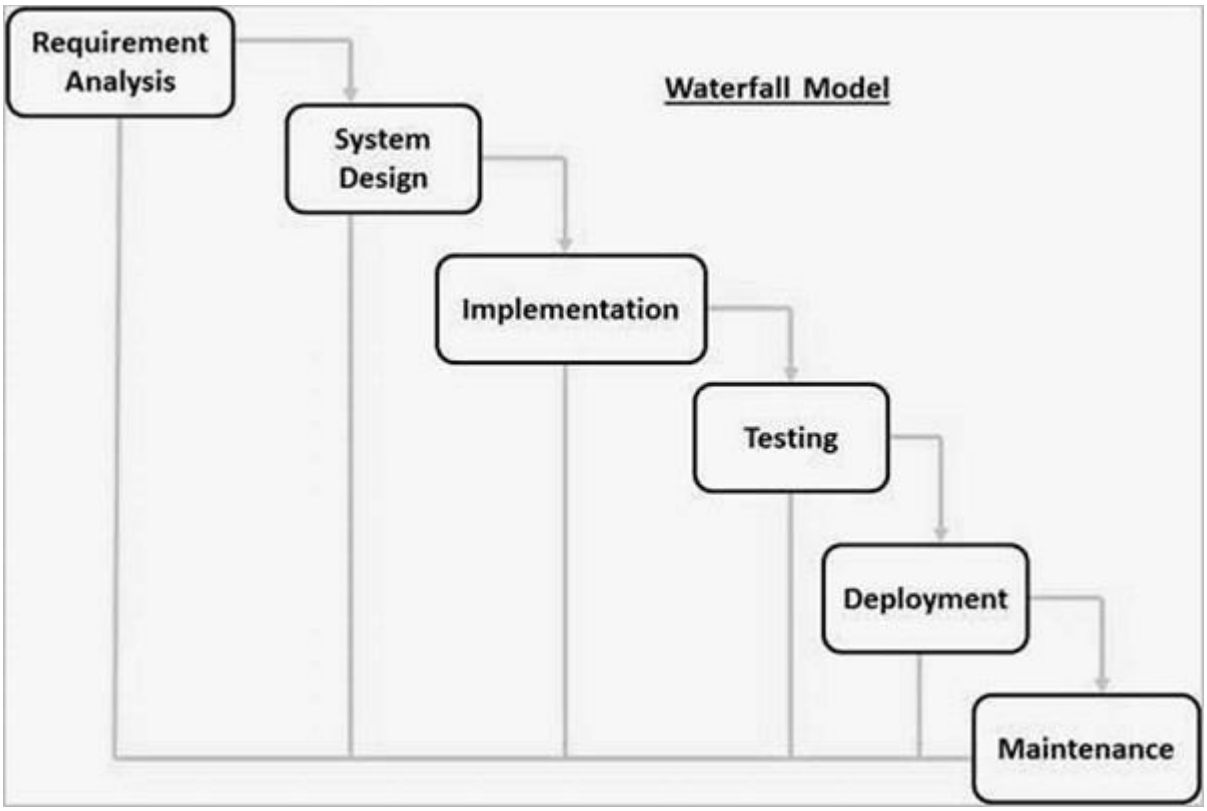
Product management methodologies are a set of principles and processes which work as a guide for managing projects (Workamajig, 2019). Each method defines how your work will go and how well your team communicates. All teams work differently, depending on each individual's skills and the type of project being done. Choosing a project methodology is one of the first and most important decisions a project manager will have to make, due to this being such an important decision, there are multiple widely used methods which have proven successful for past companies and their projects such as the Waterfall method and Rapid Applications Development (RAD). These methods and many others will be discussed and elaborated on throughout this review.

Waterfall Method

The first method I will be reviewing is the Waterfall method, which consists of moving from one phase of the project to the next only when that phase is successfully completed (Project Manager 2017). This method is the oldest method that was used for software development. It consists of several of these phases, but finishing one of these phases is final – this method does not allow you to return the previous phase, the only way to go back to a phase is to start over from phase one. Therefore, the outcome of one phase affects the next phase (Lucid Chart 2017).

These phases generally consist of, 1. Requirement gathering and documentation, 2. System design, 3. Implementation, 4. Testing, 5. Delivery, and 6. Maintenance. Using this method requires proper planning, the project must have clear cut requirements which everyone on the team understands fully. Each team member must completely understand their role in the project and what each role requires them to do. To ensure this happens, all this information is documented in a clear manner such as a flowchart and distributed to all team members so that they have something to refer back to throughout the process for clear guidance on what their roles entail, while also providing project milestones to work towards, example of such a flowchart is shown below (Lucid Chart 2017).



(Tutorials point 2020)

Documentation should take place throughout the process of the project to ensure all team members are on the same page and that the sequential process of the project is carried out. As said before, every project/software developed is different, therefore each one requires a suitable method to use as guidelines. Some situations where this method is suitable are:

- Requirements are clearly documented and straightforward.
- Technology is well understood and is not constantly changing.
- There are no ambiguous requirements.
- The project is brief.

(Tutorials point 2020)

There are advantages and disadvantages of the Waterfall method. The advantages would be that it allows more control over the project as a definitive schedule can be made with deadlines for each milestone of development for each team member. It ensures a strict regime. Some more advantages would be that its simple to use and understand, it keeps work at an efficient pace due to its rigid schedule, each phase is clearly defined and the process is thoroughly documented (Tutorials Point 2020). One drawback of the Waterfall method is that it removes the ability to reflect after each phase. Due to the sequential process, it makes altering an application in the testing phase very difficult unless it was well documented during the concept

phase. Some more disadvantages would be that a functioning prototype of the software would not be ready until the later phases of the project, it wouldn't work for complex and object-oriented projects or long, ongoing projects, and it also would not be suitable for projects that have a high chance of needing changes later on during the process (Tutorials point 2020).

Agile

Agile is best fitted to projects that are repetitive and gradual. It's a kind of process where demands and solutions evolve through the collaborative effort of self-sufficient and cross-functional teams and their customers. Originally created for software development, it had been established as a response to the inadequacies of the Waterfall method, the processes of which didn't meet the stress of the highly competitive and constant movement of the software industry (Zenkit 2018).

The Agile framework comes from the values and principles within the Agile Manifesto. Created in 2000, It provides a straightforward structure made for team collaborative work and recognizes the risk of change throughout the process. This method is more so used for more complex projects. There are six phases to document progress and to create the product, which are the product vision statement, product roadmap, product backlog, release plan, Sprint backlog, and increment. This method is best suited for complex projects which require flexibility and have a level of uncertainty (Zenkit 2018). It is a method which has methodologies within itself, such as Scrum, which I will discuss later in this review.

Scrum

As mentioned before, Scrum is a methodology which stems from Agile. It consists of five focal points: courage, openness, focus, respect and commitment. This method aims to develop and deliver complex projects through team work, self-sufficiency and iterative progress (Zenkit 2018). This ideology is what makes it so popular among project managers and developers. It is ideal for teams consisting of no more than ten people and is led by what is called a Scrum master, who is responsible for ensuring the five focal points are carried out and also helps the team do the best work they can. This structure allows the team to focus their efforts on their work and ideas. A high percentage of companies use Scrum at present such as Google, Bank of Ireland, Apple and many more (Professional Development 2020).

Lean

Lean is a methodology which aims to cut out unnecessary parts of a project, keeping it streamlined and straightforward. It promotes minimizing waste so that customer value can be maximized, basically creating more value for the customer by using less resources. This methodology supposes that 'as waste is eliminated, quality improves while the production time and cost are reduced' (Zenkit 2020). It focuses on three type of waste: Muda, Mura, and Muri.

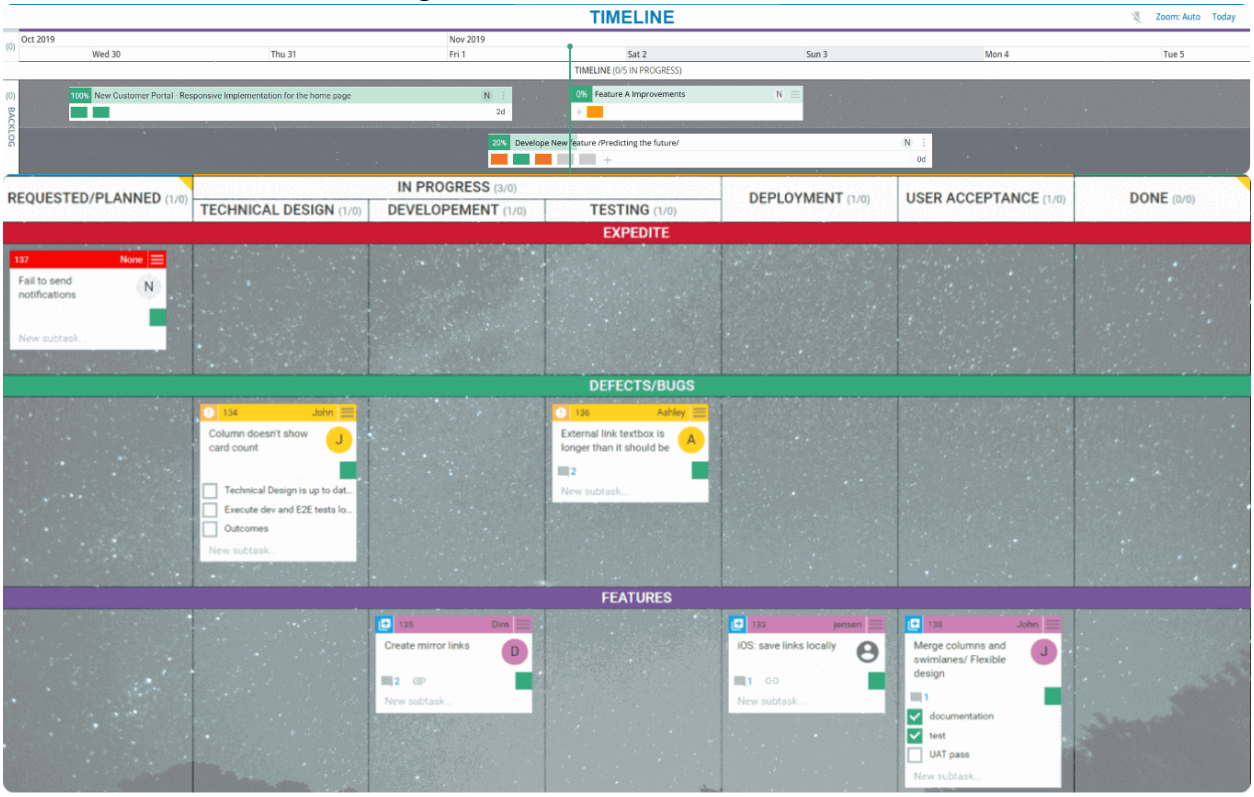
Muda focuses on getting rid of waste while also not adding any value in the process. It can be physical waste or waste in terms of resources. Mura focuses on decluttering the workflow in terms of scheduling and operation level so that the project flows smoothly. Muri focuses on removing any unnecessary stressful aspects of the process such as poor organization and using incorrect tools (Zenkit 2020).

Kanban

Kanban is a methodology which stems from Lean, which manages workflow using a Kanban board. The team members tasks are placed upon this board to ensure that the work needed to be done is presented in a clear and concise way for all participants (Project Management 2017). Kanban ensures efficiency and focuses on visualization and flow. It has been used since the 1940's as Toyota studied Kanban for the rate of demand to control the rate of production of its vehicles. It was then applied to their main plant machine shop in 1953 (Project Management 2017).

Nowadays, teams that use Agile use Kanban boards for story-boarding user stories and for planning in software development. Project teams create visual representations of their tasks, often using sticky notes and whiteboards, and move the notes throughout the process to see how they are progressing and to identify any challenges they may face. Due to the Kanban methodology expanding across multiple industries such as marketing human resources and many others, a Kanban software was created and makes this methodology accessible to all for representing project phases, task deadlines, ideas and more. An example of this software would be Kanbanize, which is an online service you sign up and pay for to make Kanban boards with your team.

Software Kanban board UAT stage



(Kanbanize 2020)

Extreme Programming

Extreme programming is a type of agile software development which consists of short development phases with multiple releases to increase and improve productivity. It aims to produce higher quality software and a higher quality of life for the team members. In terms of engineering practices for software development, extreme programming is the most specific of the agile frameworks (Agile alliance 2020). As said before, certain methods suit certain projects more so than others, this method would suit most projects with these characteristics:

- Software requirements change quite often
- Fixed time projects where risks are unnecessarily caused by new technology
- A small development team working in the same workspace as another team, also known as a co-located team
- The technology being used allows for continuous functionality tests

There are five values extreme programming focuses on: simplicity, communication, feedback, courage, and respect (Agile alliance 2020). As software development is built on teamwork, communication is key in making the workflow smooth. The most appropriate way of communicating is in person using sticky notes and a whiteboard. Constant feedback helps team members improve their work and encourages simplicity. Courage is needed for raising awareness of issues within the team and project. It is necessary for being able to accept feedback and act on it. For a team to work cohesively together, each member must respect each other and the work each member does. Respect is necessary for communication and feedback.

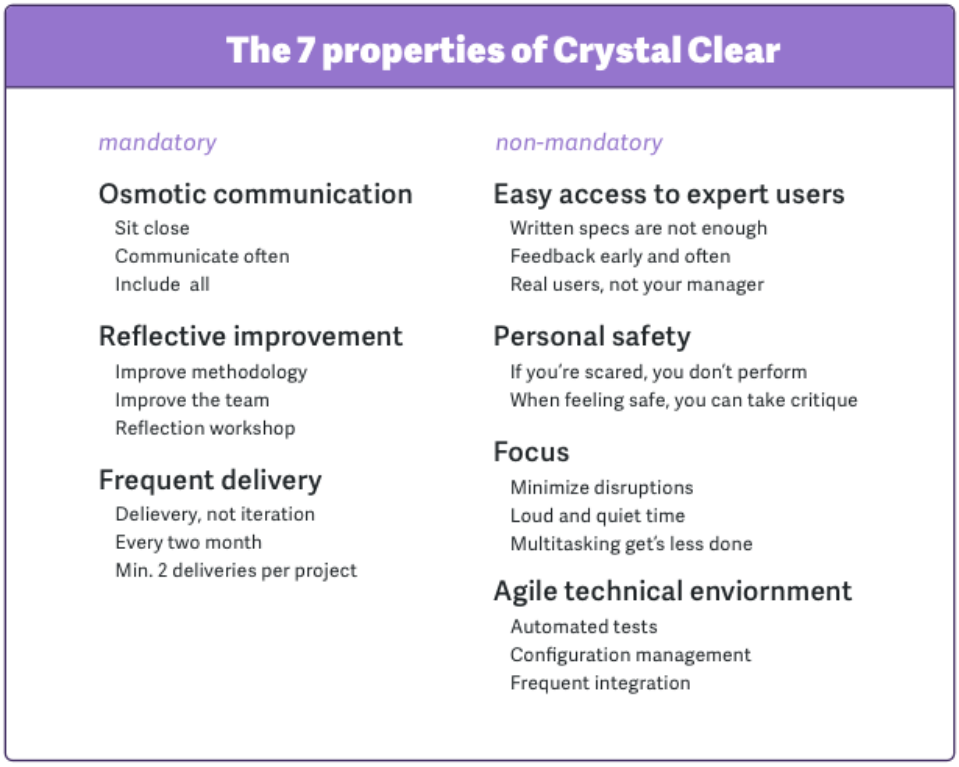
Extreme programming was first used on the Chrysler Comprehensive Compensation (C3) program by Kent Beck, when he was brought on to improve the performance of the software (Agile alliance 2020). This project was a major help in bringing extreme programming into the spotlight and the books written by several people on the project informed others about this approach.

Crystal

Crystal method is another methodology which stems from agile software development and it focuses more so on the people working on the project and how they communicate rather than focusing on the processes and tools being used. A computer scientist by the name of Alistair Cockburn developed this method in 1991 for IBM and he believed that the skills people possessed as well as their ability to communicate has the biggest impact on the outcome of the project (Active collab 2017). For this method to work, there are certain expected aspects: that teams can consistently keep their work up to date to become a more optimized team and that the projects need specific methods due to how unique or complex they are. According to Cockburn, teams should focus on asking questions like “is our product what the customer is looking for?” or “do we understand our goals as a team?” rather than focusing too much on the model and the processes (Active collab 2017).

"*Teamwork comes naturally in large software projects. We have long, mid, and short-term goals. If parts of the software are falling out of sync, it will show in our goal tracking. So, everyone collaborates to help stay on the same page and support each other*." — Kalila Lakeworth, 3D1go (Active collab 2017)

There are seven properties of the Crystal method which are split into two categories: mandatory and non-mandatory as seen below:



(Active collab 2017)

These properties are what makes this method different from other software development methodologies. Crystal focuses on flexible and configurable phases while also focusing on the user being actively involved.

Feature Driven Development (FDD)

Feature driven development is another agile framework which focuses on making progress on features in the project. By features, it means not necessarily the typical kinds of features people might think of, rather, features like "complete the login process" (Product Plan 2020). It was first used by a 50-person software development team in Singapore in a financial based institution. This method consists of five steps which each focus on small feature projects.

1. Developing an overview of the model
2. Create a list of the features
3. Plan out each feature
4. Design each feature

5. Build each feature
   (Product Plan 2020)

This methodology can be a good choice as it is a simple process, making it more efficient and it also allows larger teams to efficiently move products forward with consistent success but it will not work as well with smaller projects as it would be less efficient and there is little to no documentation which can lead to confusion within the team.

PRINCE2

PRINCE2 stands for Projects In Controlled Environments. It is a method which focuses on the process and is mainly used in the UK but is widely recognized internationally. It states that a project should have an organized and controlled start, middle, and end (Prince2 2020) There are many different roles within the team such as Project Manager, Customer, user and supplier, and Project board. Everyone is given their own role to focus on making it more efficient. This method allows the team to have more control over the resources and allows them to avoid risk successfully. There are seven principles of PRINCE2:

1. Projects must have a clear business outline – detailing cost and customer needs

2. Learning aspect for the team in each phase

3. Clearly defined roles and responsibilities

4. Work is planned in phases – broken up into individual phases for each member, with consistent reviews to record lessons learned and to ensure requirements are met

5. Manage project boards – project manager keeps project on track and fixes any issues that may arise

6. Teams keep focus on the quality of the work

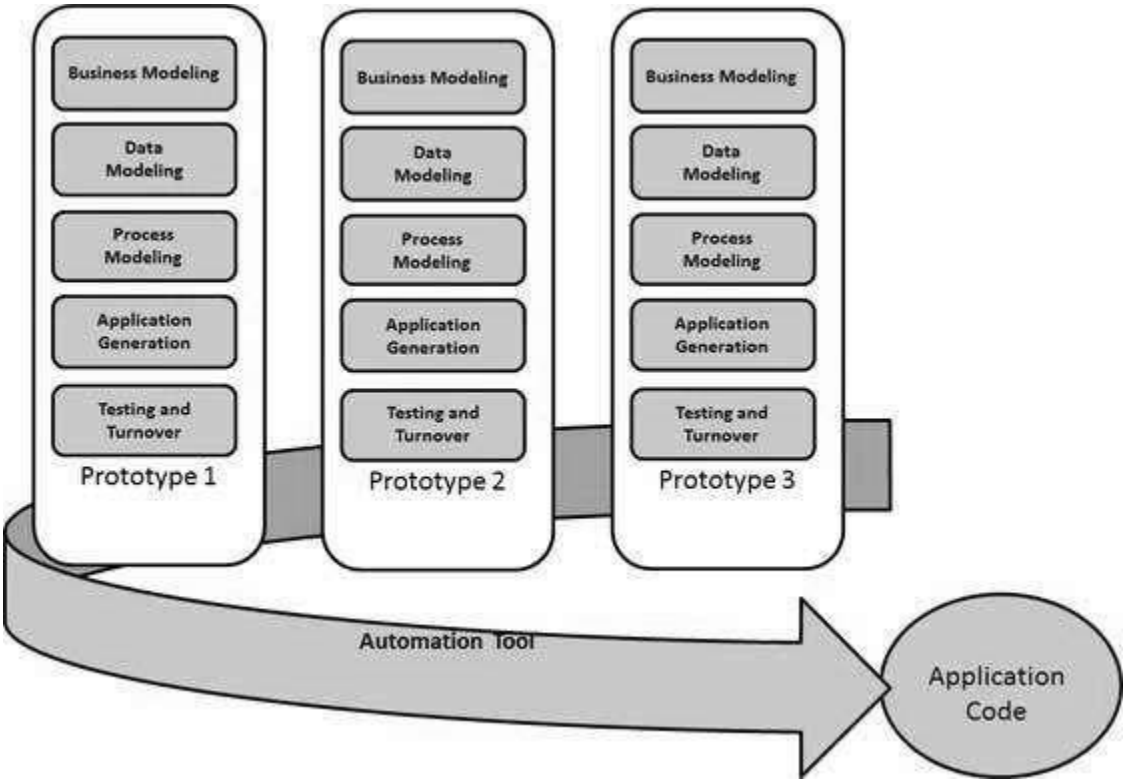
7. The approach is altered to suit the needs of each project

   (Wrike 2019)

Rapid Applications Development (RAD)

The Rapid Application Development methodology requires minimal planning to allow rapid prototyping. It focuses on the customers requirements by doing focus groups, early testing done by the customer themselves, reusing certain parts of prototypes and continuous application of those parts with rapid delivery of product (Tutorials point 2020). This

methodology consists of small teams made up of developers, customer representatives and other IT resources who work consistently on their own part or prototype. These prototypes must be reusable in order for the model to be successful. The RAD model spreads phases into short, repetitive development phases. In the image below, the various phases for the model are explained in a straight forward and detailed way.



(Tutorials point 2020)

The RAD methodology can be used in projects that can be broken into modules, if this is not possible then RAD will not work. These are the situations where Rad can be applied:

- When a project can be put into modules to be delivered step-by-step
- If designers are available for the modelling
- If the budget can afford the use of automated code generating tools
- Should only be used if domain experts with the appropriate amount of experience and business knowledge are available
- Where requirements are frequently changing during the process and functional prototypes are delivered to the customer in small iterations if perhaps 2-3 months (Tutorials point 2020)

Dynamic Systems Development Method (DSDM)

The Dynamic Systems Development Method is another Agile method which focuses on the entirety of the project lifecycle (Agile business 2020). Created in 1994, its success was due mostly to the philosophy *"that any project must be aligned to clearly defined strategic goals and focus upon early delivery of real benefits to the business.".* This philosophy is supported by eight principles which keeps the team focused which allows them to achieve project goals. The eight principles are as follows:

1. Focus on the needs of the business
2. Deliver when meant to
3. Collaboration
4. Communication consistently and clearly
5. Ensure high quality
6. Build step by step from finished phases
7. Develop iteratively
8. Keep control over work
   (Agile business 2020)

DSDM ensures on time high quality delivery of projects and has been proven to cover projects of all sizes, in any sector. However, this methodology can be costly to implement isn't really ideal for small organizations.

Rational Unified Process (RUP)

Rational Unified Process is a method that was developed by the Rational division of IBM. It consists of four phases that each involve analysis and design, business modelling, implementation, testing and delivery (Tech terms 2020). These four phases are:

1. Inception – idea for the project is established and it is determined whether or not it's worth pursuing
2. Elaboration – further evaluation is done to figure out the layout of the project and the resources required. The cost of the development is also considered.
3. Construction – the project has gone through all the phases and is completed. The software is designed, created, and then tested

4. Transition – software is released and any changes or updates that are needed are made based off of feedback from the users.
   (Tech terms 2020)

As this methodology provides a specific step by step plan, it helps to prevent useful resources and costs from being wasted during the development process. Companies which use this method are mostly found in the United States, and it is most often used by companies that have around 50-200 employees and around 10M-50M (€8,254,911.67 - € 41,271,492.13) dollars in revenue (enlyft 2020).

References

Workamajig. (2019). The Definitive Guide to Project Management Methodologies, [online] available: https://www.workamajig.com/blog/project-management-methodologies [accessed 6 December 2020]

Project Manager. (2017). Project Management Methodologies – An Overview, [online] available: https://www.projectmanager.com/blog/project-management-methodology [accessed 6 December 2020]

Lucid Chart. (2017). What the Waterfall Project Management Methodology Can (and Can't) Do for You, [online] available: https://www.lucidchart.com/blog/waterfall-project-management-methodology#:~:text=Simply%20put%2C%20waterfall%20project%20management,return%20to%20a%20previous%20phase. [accessed 6 December 2020]

Tutorials Point. (2020). SDLC - Waterfall Model, [online] available: https://www.tutorialspoint.com/sdlc/sdlc_waterfall_model.htm#:~:text=The%20Waterfall%20model%20is%20the,the%20previous%20phase%20is%20complete. [accessed 6 December 2020]

Zenkit. (2018). 7 Popular Project Management Methodologies And What They're Best Suited For, [online] available: https://zenkit.com/en/blog/7-popular-project-management-methodologies-and-what-theyre-best-suited-for/ [accessed 7 December 2020]

Professional Development. (2020). Who Uses Scrum? [online], available: https://www.professionaldevelopment.ie/who-uses-scrum [accessed 7 December 2020]

Kanbanize. (2020). 32 Practical Kanban Board Examples, [online] available: https://kanbanize.com/kanban-resources/kanban-software/kanban-board-examples [accessed 7 December 2020]

Agile Alliance. (2020). Extreme Programming, [online] available: https://www.agilealliance.org/glossary/xp/#q=~(infinite~false~filters~(postType~(~'post~'aa_book~'aa_event_session~'aa_experience_report~'aa_glossary~'aa_research_paper~'aa_video)~tags~(~'xp))~searchTerm~'~sort~false~sortDirection~'asc~page~1) [accessed 8 December 2020]

Active Collab. (2017). What is Crystal Method? [online] available: https://activecollab.com/blog/project-management/crystal-methods#:~:text=Crystal%20method%20is%20an%20agile,than%20on%20processes%20and%20tools.&text=Crystal%20Method%20is%20based%20on,become%20a%20more%20optimized%20team [accessed 8 December 2020]

Product Plan. (2020). Feature Driven Development (FDD), [online] available: https://www.productplan.com/glossary/feature-driven-development/ [accessed 8 December 2020]

Prince2. (2020). PRINCE2 Methodology [online] available: https://www.prince2.com/eur/prince2-methodology#:~:text=PRINCE2%20%2D%20A%20Structured%20Project%20Management,in%20the%20UK%20and%20internationally. [accessed 9 December 2020]

Wrike. (2019). PRINCE2: The Reigning Project Management Methodology, [online] available: https://www.wrike.com/blog/project-management-basics-prince2-explained/ [accessed 9 December 2020]

Tutorials Point. (2020). SDLC - RAD Model, [online] available: https://www.tutorialspoint.com/sdlc/sdlc_rad_model.htm [accessed 9 December 2020]

Agile Business. (2020). What is DSDM? [online] available: https://www.agilebusiness.org/page/whatisdsdm#:~:text=What%20is%20DSDM%3F-,DSDM%20is%20an%20Agile%20method%20that%20focuses%20on%20the%20full,new%20iterative%20way%20of%20working. [accessed 9 December 2020]

Tech Terms. (2020). RUP Definition, [online] available: https://techterms.com/definition/rup [accessed 9 December 2020]

Enlyft. (2020). Companies using IBM Rational Unified Process, [online] available: https://enlyft.com/tech/products/ibm-rational-unified-process [accessed 10 December 2020]