

IT4305: Rapid Software Development

BIT – 2nd Year
Semester 4

Learning Outcome

After successful completion of this course students will be able to:

- Describe Agile principles
- Explain how Agile principles differ from traditional, plan-driven, sequential product development

Outline of Syllabus

- Introduction
- Variability and Uncertainty
- Prediction and Adaptation
- Validated Learning
- Work in Process (WIP)
- Progress
- Performance
- Comparison Summary of Plan-Driven and Agile Principles

References

1. Essential Scrum Practical Guide to the Most Popular Agile Process by Kenneth S. Rubin.
2. The Art of Agile Development by James Shore and Shane Warden
3. Agile and Iterative Development: A Manager's Guide by Craig Larman, Agile Software development series, Alistair Cockburn and Jim Highsmith, Series Editors
4. <http://agilemanifesto.org>
5. <https://msdn.microsoft.com/en-us/library/hh533841.aspx>

IT4305: Rapid Software Development

Agile Principles

Duration: 03 hours

Learning Objectives

- Describe Agile principles
- Explain how Agile principles differ from traditional, plan-driven, sequential product development

Detailed Syllabus

2.1 Introduction

2.2 Variability and Uncertainty

2.3 Prediction and Adaptation

2.4 Validated Learning

2.5 Work in Process (WIP)

2.6 Progress

2.7 Performance

2.8 Comparison Summary of Plan-Driven and Agile Principles

2.1 INTRODUCTION

- Agile principles

- Agile principles make organizations robust & antifragile
- Embracing Agile principles makes the development process and organization robust and at times antifragile to the disorder of uncertain events, avoiding harm and reaping benefits of uncertainty
- These principles are organized into several categories

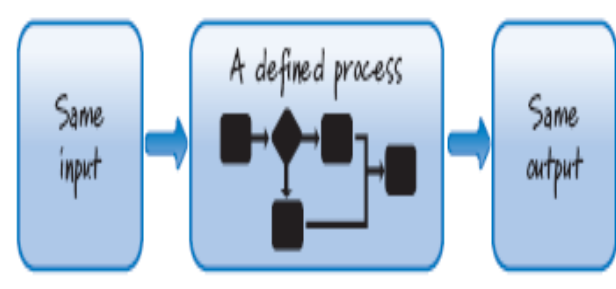
Principles



2.2 VARIABILITY AND UNCERTAINTY

- Four Principles under Variability and Uncertainty
 1. Embrace helpful variability.
 2. Employ iterative and incremental development.
 3. Leverage variability through inspection, adaptation, and transparency.
 4. Reduce all forms of uncertainty simultaneously.

2.2.1 Embrace helpful variability

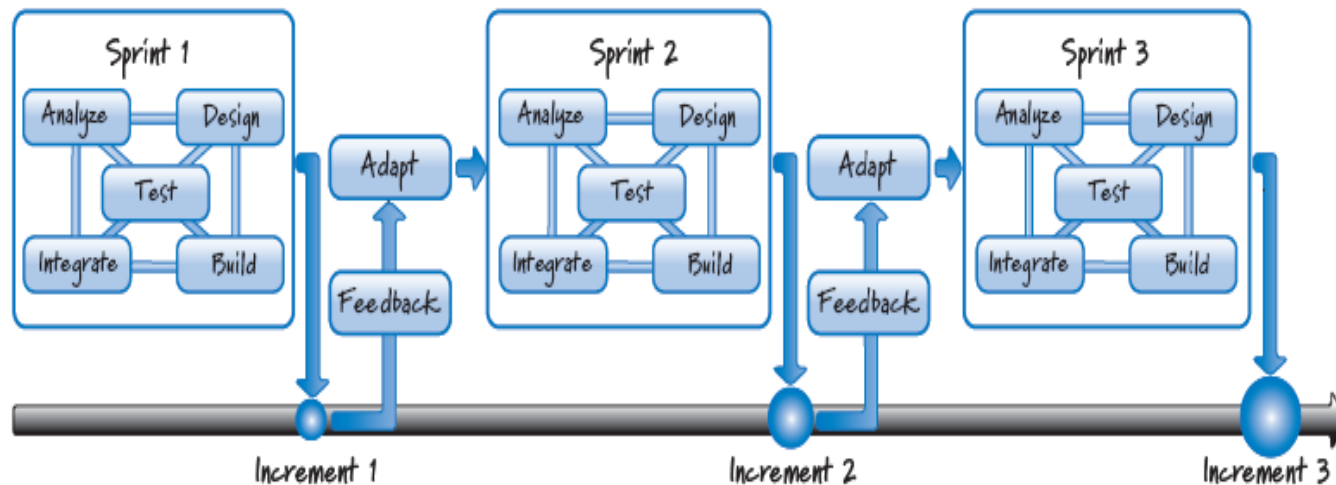
Plan-driven development	Agile Development
<ul style="list-style-type: none"> • treat product development like manufacturing—they shun variability • and encourage conformance to a defined process. • The problem is that product development is not at all like product manufacturing. In manufacturing our goal is to take a fixed set of requirements and follow a sequential set of well-understood steps to manufacture a finished product that is the every time 	<p>In product development, the goal is to create the unique <i>single instance</i> of the product not to <i>manufacture</i> the product</p> <p>Some amount of variability is necessary to produce a different product each time</p> <div data-bbox="1101 899 1777 1213">  <pre> graph LR Input[Same input] --> Process[A defined process] subgraph ProcessBox [A defined process] direction LR P1[] --> P2{ } P2 --> P3[] P2 --> P4[] P3 --> P5[] P4 --> P5 end ProcessBox --> Output[Same output] </pre> </div> <p>Fig. 1 Defined Process</p>

2.2.2 Employ iterative and incremental development



Plan-driven development	Agile Development
<ul style="list-style-type: none">• assumes that we will get things right up front• and that most or all of the product pieces will come together late in the effort	<p>iterative development is a planned rework strategy use multiple passes to improve what we are building so that we can converge on a good solution. start by creating a prototype to acquire important knowledge about a poorly known piece of the product an excellent way to improve the product as it is being developed.</p> <p>incremental development “Build some of it before you build all of it.” break the product into smaller pieces so that we can build some of it, learn how each piece is to survive in the environment The biggest drawback to incremental development is that by building in pieces, we risk missing the big picture (ex. we see the trees but not the forest))</p>

- Employ iterative and incremental development
- Usage of “iterative and incremental development” in Scrum



- Sprints : series of time boxed iterations
- During each sprint we perform all of the activities necessary to create a working product increment

- No need to work on a phase at a time; have to work on a feature at a time.
- By the end of a sprint we have created a valuable product increment
- That increment includes or is integrated and tested with any previously developed features; otherwise, it is not considered done
- At the end of the sprint, we can get feedback on the newly completed features within the context of already completed features.
- After receiving feedback on the sprint results, we can choose different features to work on in the next sprint or alter the process we will use to build the next set of features.
- Sometimes we can schedule rework for a future sprint
- Scrum does not require that we predetermine a set number of iterations
- The continuous stream of feedback
- will guide us to do the appropriate and economically sensible number of iterations

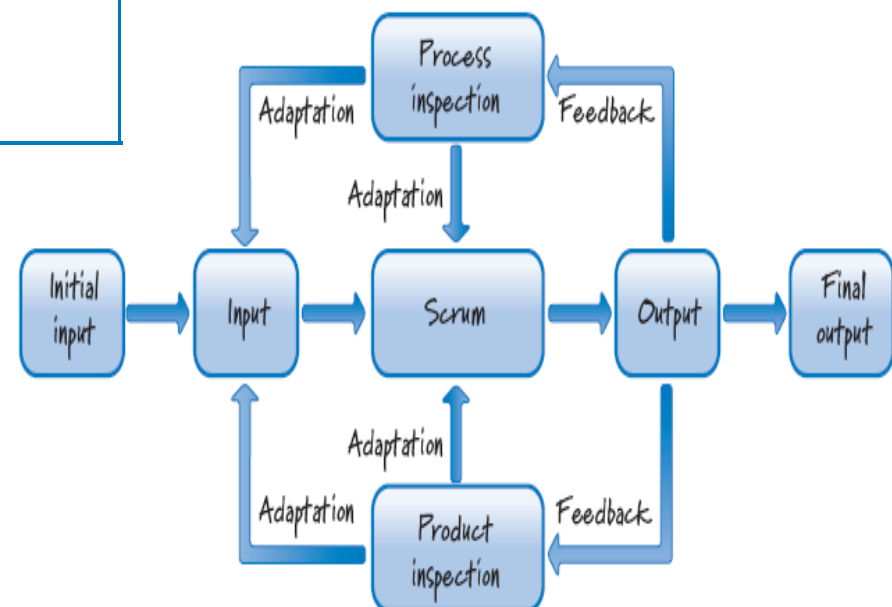
2.2.3 Leverage variability through inspection, adaptation, and transparency

Plan-driven development	Agile Development
<ul style="list-style-type: none"> • assumes little or no output variability. • It follows a well-defined set of steps and uses only small amounts of feedback late in the process. 	<ul style="list-style-type: none"> • In Scrum, we inspect and adapt not only what we are building but also how we are building it • To do this well, we rely on transparency <ul style="list-style-type: none"> • all of the information that is important to producing a product must be available to the people involved in creating the product • Transparency makes inspection possible, which is needed for adaptation • It leads to more communication and it establishes trust

2.2.3 Leverage variability through inspection, adaptation, and transparency

Dimension	Plan-Driven	Scrum
Degree of process definition	Well-defined set of sequential steps	Complex process that would defy a complete up-front definition
Randomness of output	Little or no output variability	Expect variability because we are not trying to build the same thing over and over
Amount of feedback used	Little and late	Frequent and early

Refer to Ref.1 pg.36



2.2.4 Reduce all forms of uncertainty simultaneously



- Developing new products is a complex endeavor with a high degree of uncertainty
 - **End uncertainty** (*what* uncertainty)—uncertainty surrounding the features of the final product
 - **Means uncertainty** (*how* uncertainty)—uncertainty surrounding the process and technologies used to develop a product
 - there might also be **customer uncertainty** (*who* uncertainty)

Plan-driven development	Agile Development
<ul style="list-style-type: none">• focuses first on eliminating all end uncertainty by fully defining up front what is to be built, and only then addressing means uncertainty. <p data-bbox="454 1356 898 1413">Refer to Ref.1 pg.36-37</p>	<ul style="list-style-type: none">• focuses on simultaneously reducing all uncertainties (end, means, customer, and so on).<ul style="list-style-type: none">• Simultaneously addressing multiple types of uncertainty is facilitated by iterative and incremental development and guided by constant inspection, adaptation, and transparency.<ul style="list-style-type: none">• to identify and learn about the unknown unknowns

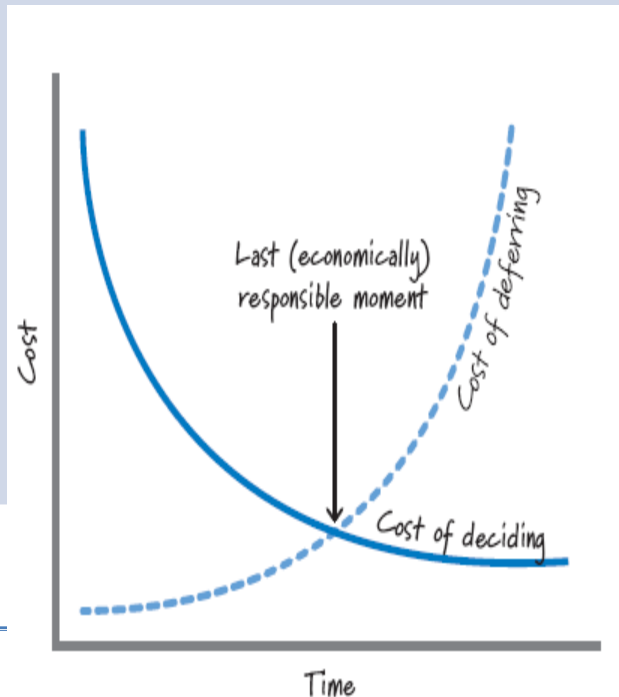
2.3 PREDICTION AND ADAPTION

- When using Scrum, constantly balance the desire for prediction with the need for adaptation
- Five agile principles related Prediction and Adaption
 - Keep options open.
 - Accept that you can't get it right up front.
 - Favor an adaptive, exploratory approach.
 - Embrace change in an economically sensible way.
 - Balance predictive up-front work with adaptive just-in-time work.

2.3.1 Keep Options Open

Plan-driven development

- requires that important decisions in areas like requirements or design be made, reviewed, and approved within their respective phases



Agile Development

- But Scrum favors a strategy of keeping options open
 - referred to as the **last responsible moment (LRM)** - we delay commitment and do not make important and irreversible decisions until the last responsible moment
 - When dealing with important or irreversible decisions, if we decide too early and are wrong

Refer to Ref.1 pg.37 - 38

2.3.2 Accept That You Can't Get It Right Up Front

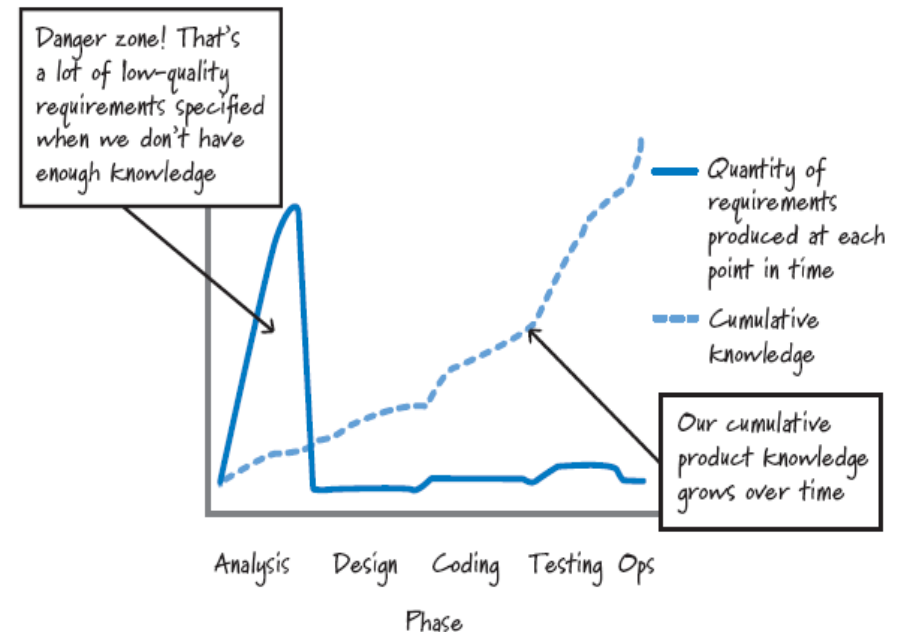


Plan-driven development

- mandates full requirements and a complete plan; they also assume that we can “get it right” up front.
- The reality is that it is very unlikely that we can get all of the requirements, or the detailed plans based on those requirements, correct up front.
- What's worse is that when the requirements do change, we have to modify the baseline requirements and plans to match the current reality

Agile Development

- acknowledge that we can't get all of the requirements or the plans right up front
- With Scrum, we still produce some requirements and plans up front, but just sufficiently, and with the assumption that we will fill in the details of those requirements and plans as we learn more about the product



2.3.3 Favor an Adaptive, Exploratory Approach

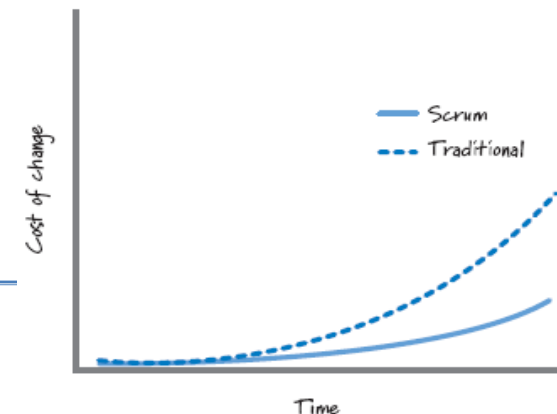


Plan-driven development	Agile Development
<ul style="list-style-type: none">• focuses on using (or exploiting) what is currently known and predicting what isn't known.	<ul style="list-style-type: none">• Scrum favors a more adaptive, trial-and error approach based on appropriate use of exploration<ul style="list-style-type: none">• Exploration refers to times when we choose to gain knowledge by doing some activity, such as building a prototype, creating a proof of concept, performing a study, or conducting an experiment. i.e. when faced with uncertainty, we buy information by exploring.• feedback from our action will help us determine if and when we need further exploration.

2.3.4 Embrace change in an economically sensible way

- we assume that change is the norm.
- Goal is to keep the cost-of-change curve flat (Fig 1) for as long as possible making it economically sensible to embrace even late change
- can achieve that goal by managing the amount of work in process and the
- flow of that work so that the cost of change when using Scrum is less affected by time than it is with sequential projects.

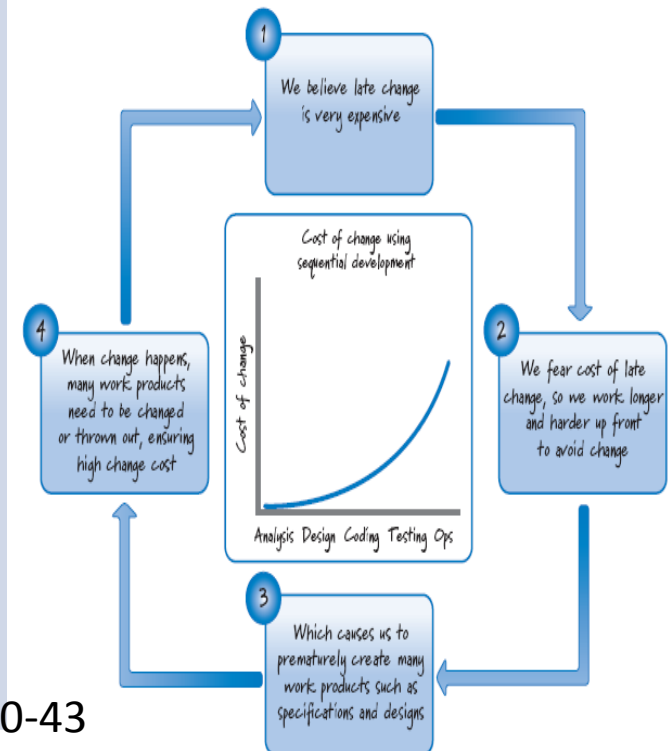
Refer to Ref.1 pg.40-41



2.3.4 Embrace change in an economically sensible way



Plan-driven development	Agile Development
<ul style="list-style-type: none">• as we have all learned, is substantially more expensive late than it is early on• seek to carefully control and minimize any changing requirements or designs by improving the accuracy of the predictions about what the system needs to do or how it is supposed to do it.	<ul style="list-style-type: none">• we produce many work products in a just-in-time fashion, avoiding the creation of potentially unnecessary artifacts.• When developing with Scrum, there does come a time when the cost of change will no longer be proportional to the size of the request, but this point in time the inflection point on the Scrum curve occurs later.

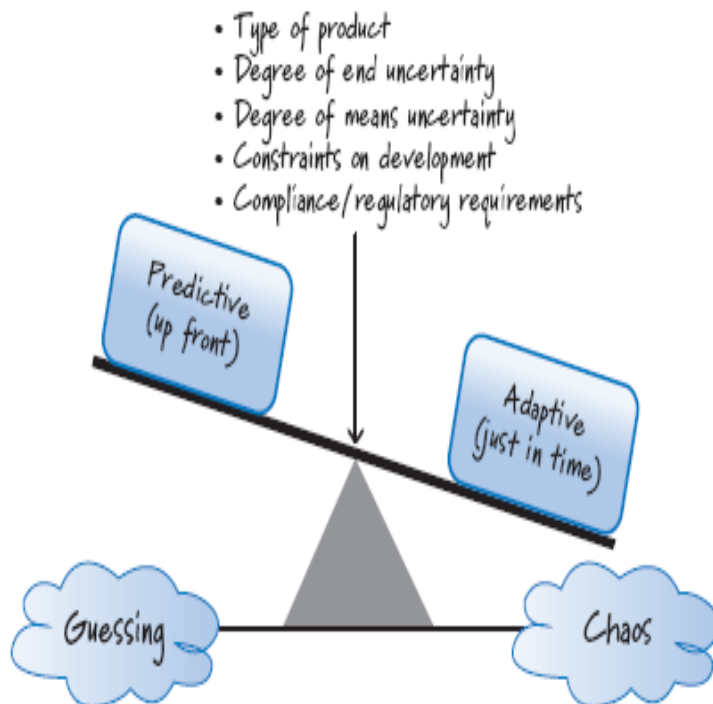


Refer to Ref.1 pg.40-43

2.3.5 Balance predictive up-front work with adaptive just-in-time work



Plan-driven development	Agile Development
<ul style="list-style-type: none">• detailed up-front requirements and planning are critical and should be completed before moving on to later stages.	<ul style="list-style-type: none">• up-front work should be helpful without being excessive.• Scrum, acknowledges that it is not possible to get requirements and plans precisely right up front.• Scrum is about finding balance between predictive up-front work and adaptive just-in-time work



Refer to Ref.1 pg.44

2.3.5 Balance predictive up-front work with adaptive just-in-time work



- the balance point should be set in an economically sensible way to maximize the amount of ongoing adaptation based on fast feedback and minimize the amount of up-front prediction, while still meeting compliance, regulatory, and/or corporate objectives.
 - balance is achieved is driven in part by the type of product being built, the degree of uncertainty that exists in both what we want to build and how we want to build it and the constraints placed on the development.
 - Being overly predictive would require us to make many assumptions in the presence of great uncertainty. Being overly adaptive could cause us to live in a state of constant change, making our work feel inefficient and chaotic.
 - To rapidly develop innovative products we need to operate in a space where adaptability is counterbalanced by just enough prediction to keep us from sliding into chaos.

– The Scrum framework operates well at this balance point of order and chaos.

Refer to Ref.1 pg.44

2.4 VALIDATED LEARNING

- Can acquire validated learning when we obtain knowledge that confirms or refutes an assumption that we have made.
 - Three agile principles related to this topic:
 - Validate important assumptions fast.
 - Leverage multiple concurrent learning loops.
 - Organize workflow for fast feedback.

2.4.1 Validate important assumptions fast

- Assumptions represent a significant development **risk**.

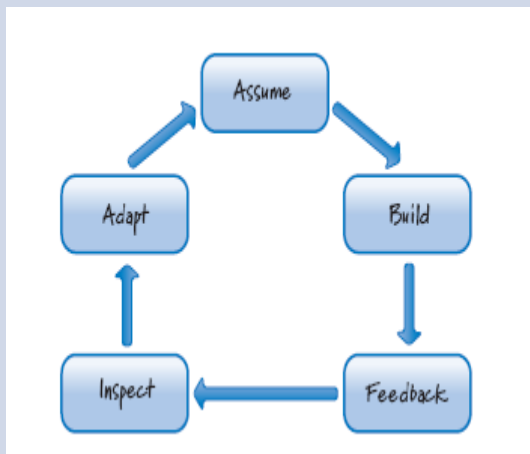
Plan-driven development	Agile Development
<ul style="list-style-type: none">• much more tolerant of long-lived assumptions than Scrum. Using plan-driven development, we produce extensive up-front requirements and plans that likely embed many important assumptions, ones that won't be validated until a much later phase of development.	<ul style="list-style-type: none">• try to minimize the number of important assumptions that exist at any time.• don't want to let important assumptions exist without validation for very long• As a result, if we make a fundamentally bad assumption when using Scrum, we will likely discover our mistake quickly and have a chance to recover from it.

2.4.2 Leverage multiple concurrent learning loops



Plan-driven development

- There is learning that occurs when using sequential development. However, an important form of learning happens only after features have been built, integrated, and tested, which means considerable learning occurs toward the end of the effort.
- Late learning provides reduced benefits because there may be insufficient time to leverage the learning or the cost to leverage it might be too high



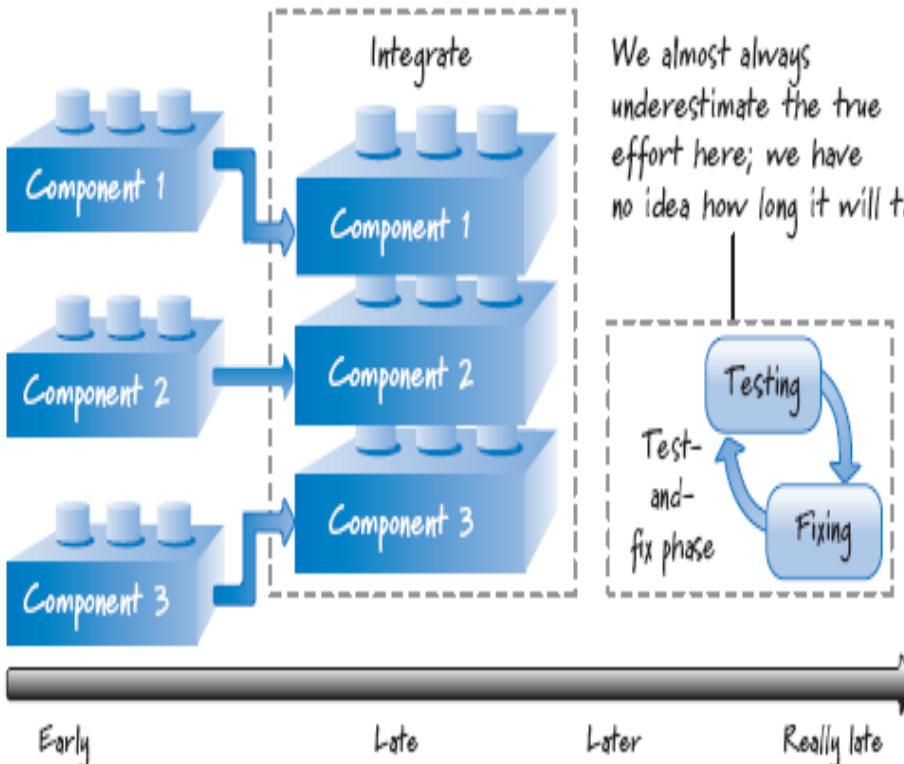
Agile Development

- Scrum identifies and exploits feedback loops to increase learning
- Recurring pattern in this style of product development is to make an assumption (or set a goal),
 - build something (perform some activities),
 - get feedback on what we built,
 - use that feedback to inspect what we did relative to what we assumed.
- Make adaptations to the product, process, and/or our beliefs based on what we learned
 - Ex: pair programming (feedback in seconds)
 - test-driven development (feedback in minutes)

Refer to Ref.1 pg.45

2.4.3 Organize workflow for fast feedback



Plan-driven development	Agile Development
<p>tolerant of late learning, so fast feedback is not a focus.</p>  <p>The diagram illustrates a plan-driven development workflow. On the left, three blue blocks labeled 'Component 1', 'Component 2', and 'Component 3' are shown in an 'Early' phase. Arrows point from each component to a corresponding component in a dashed box labeled 'Integrate' in the 'Late' phase. A timeline at the bottom shows 'Early', 'Late', 'Later', and 'Really late' stages. A handwritten note above the 'Integrate' box states: 'We almost always underestimate the true effort here; we have no idea how long it will take'. To the right of the 'Integrate' box is a dashed box labeled 'Test-and-fix phase' containing 'Testing' and 'Fixing' steps in a loop.</p>	<ul style="list-style-type: none">organize the flow of work to move through the learning loop in and get to feedback as quickly as possible. In doing so, we ensure that feedback-generating activities occur in close time proximity to the original work.<ul style="list-style-type: none">Ex: component integration and testing<ul style="list-style-type: none">At some time these components have to be integrated and tested before making a shippable product. Until we try to do the integration, we really don't know whether we have developed the components correctly. Attempting the integration will provide critical feedback on the component development work.

2.5 WORK IN PROCESS (WIP)

- work that has been started but not yet finished.
- During product development WIP must be recognized and properly managed.
- agile principles related to this topic:
 - Use economically sensible batch sizes.
 - Recognize inventory and manage it for good flow.
 - Focus on idle work, not idle workers.
 - Consider cost of delay.

Use economically
sensible batch sizes

Plan-Driven
Development

- » it is preferable
to batch up all
of one

type of work and
perform it in a single
phase.

Benefit	Description
Reduced cycle time	Smaller batches yield smaller amounts of work waiting to be processed, which in turn means less time waiting for the work to get done. So, we get things done faster.
Reduced flow variability	Think of a restaurant where small parties come and go (they flow nicely through the restaurant). Now imagine a large tour bus (large batch) unloading and the effect that it has on the flow in the restaurant.
Accelerated feedback	Small batches accelerate fast feedback, making the consequences of a mistake smaller.
Reduced risk	Small batches represent less inventory that is subject to change. Smaller batches are also less likely to fail (there is a greater risk that a failure will occur with ten pieces of work than with five).
Reduced overhead	There is overhead in managing large batches—for example, maintaining a list of 3,000 work items requires more effort than a list of 30.
Increased motivation and urgency	Small batches provide focus and a sense of responsibility. It is much easier to understand the effect of delays and failure when dealing with small versus large batches.
Reduced cost and schedule growth	When we're wrong on big batches, we are wrong in a big way with respect to cost and schedule. When we do things on a small scale, we won't be wrong by much.



Recognize Inventory and Manage It for Good Flow

- keep some inventory on hand but use a healthy dose of just-in-time inventory management
- requirements are just one form of inventory that exists in product development exists in product development
- too many requirements, we will likely experience inventory waste when requirements change

Focus on Idle Work, Not Idle Workers

- idle work :we are blocked waiting on another team to do something
- Idle workers : people who have available capacity to do more work because they are not currently 100% utilized
- In plan-driven development : focus more on eliminating the waste of idle workers than on the waste of idle work.
- The idle work (delayed work) grows exponentially once we get into the high levels of utilization.
- acutely aware that finding the bottlenecks in the flow of work and focusing our efforts on eliminating them is a far more economically sensible activity than trying to keep everyone 100% busy

2.4.4.4 Consider Cost of Delay

- financial cost associated with delaying work or delaying achievement of a milestone

To read more on this and to read an example : go to Ref 1 : pg 51

2.6 PROGRESS

measure progress by what we have delivered and validated, not by how we are proceeding according to the predefined plan or how far we are into a particular phase or stage of development.

Three agile principles;

- Adapt to real-time information and replan.
- Measure progress by validating working assets.
- Focus on value-centric delivery.

2.6.1 Adapt to Real-Time Information and Replan

Plan-driven development	Agile Development
<ul style="list-style-type: none"> the plan is the authoritative source on how and when work should occur. As such, conformance to the plan is expected 	<ul style="list-style-type: none"> goal is to rapidly replan and adapt to the stream of economically important information that is continuously arriving during the development effort

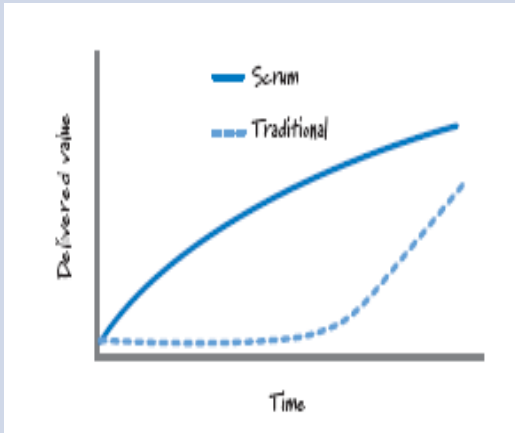


2.6.2 Measure progress by validating working assets



Plan-driven development	Agile Development
<ul style="list-style-type: none">• effort is demonstrated by completing a phase and being permitted to enter the next phase. As a result, if each phase starts and completes as expected, the product development effort might seem to be progressing quite well.• In the end, the product we created in full accordance with the plan might deliver far less customer value than anticipated.	<ul style="list-style-type: none">• measure progress by building working, validated assets that deliver value and that can be used to validate important assumptions.• gives us the feedback to know what the right next step is.• It's not about how much work we start; it's all about what customer-valuable work we finish

2.6.3 Focus on value-centric delivery

Plan-driven development	Agile Development
<ul style="list-style-type: none"> • focuses on diligently following the process. By its very structure, the integration and delivery of features during sequential development happen at the end of the effort • With this approach there is a risk that we will run out of resources (time or money) before we deliver all of the important value to our customers.  <p>Deliver high-value features sooner</p>	<ul style="list-style-type: none"> • a customer-value-centric form of development. • based on a prioritized, incremental model of delivery in which the highest-value features are continuously built and delivered in the next iteration. As a result, customers get a continuous flow of high-value features sooner. • value is generated by delivering working assets to customers, by validating important assumptions, or by acquiring valuable knowledge • the intermediate artifacts provide no perceived customer value and are merely a means to an end if they themselves cannot be used to generate important feedback or acquire important knowledge <p>Refer to Ref 1 : pg 55</p>

2.7 PERFORMANCE

- Agile Principles related to this
 - Go fast but never hurry.
 - Build in quality.
 - Employ minimally sufficient ceremony.

2.7.1 Go fast but never hurry

Plan-driven development	Agile Development
<ul style="list-style-type: none"> • Plan-driven development believes that if we follow the plan and do things right the first time, we'll avoid costly and time-consuming rework. • Moving from step to step quickly is of course desirable, but it isn't a principal goal. 	<ul style="list-style-type: none"> • one core goal is to be nimble, adaptable, and speedy. By going fast, we deliver fast, we get feedback fast, and we get value into the hands of our customers sooner. Learning and reacting quickly allow us to generate revenue and/or reduce costs sooner.

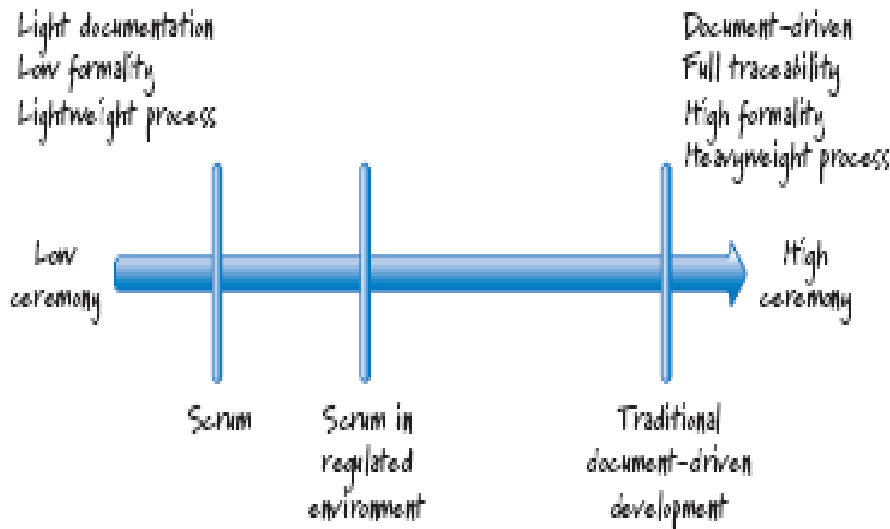
2.7.2 Build in quality

Plan-driven development	Agile Development
<ul style="list-style-type: none"> the belief is that through careful, sequential performance of work we get a high-quality product. we can't actually verify this quality until we do the testing of the integrated product, which occurs during a late phase of the process. If testing should indicate that the quality is lacking, we then must enter the costly test-and-fix phase in an attempt to test quality in. Also, because a different team frequently works on each phase, the testing team is often viewed as owning the quality of the result 	<ul style="list-style-type: none"> quality isn't something a testing team "tests in" at the end; it is something that a cross-functional Scrum team owns and continuously builds in and verifies every sprint Each increment of value that is created is completed to a high level of confidence and has the potential to be put into production or shipped to customers the need for any significant late testing to tack on quality is substantially reduced

2.7.3 Employ minimally sufficient ceremony



Plan-driven development	Agile Development
<ul style="list-style-type: none">tend to be high-ceremony, document-centric, process-heavy approaches.	<ul style="list-style-type: none">goal is to eliminate unnecessary formality. Therefore, we set the ceremonial bar at a low level, one that is minimally sufficient or good enough.No dead documents



Ceremony scale



Summary

Topic	Plan-Driven Principle	Agile Principle
Similarity between development and manufacturing	Both follow a defined process.	Development isn't manufacturing; development creates the recipe for the product.
Process structure	Development is phase-based and sequential.	Development should be iterative and incremental.
Degree of process and product variability	Try to eliminate process and product variability.	Leverage variability through inspection, adaptation, and transparency.
Uncertainty management	Eliminate end uncertainty first, and then means uncertainty.	Reduce uncertainties simultaneously.
Decision making	Make each decision in its proper phase.	Keep options open.
Getting it right the first time	Assumes we have all of the correct information up front to create the requirements and plans.	We can't get it right up front.

Topic	Plan-Driven Principle	Agile Principle
Exploration versus exploitation	Exploit what is currently known and predict what isn't known.	Favor an adaptive, exploratory approach.
Change/emergence	Change is disruptive to plans and expensive, so it should be avoided.	Embrace change in an economically sensible way.
Predictive versus adaptive	The process is highly predictive.	Balance predictive up-front work with adaptive just-in-time work.
Assumptions (unvalidated knowledge)	The process is tolerant of long-lived assumptions.	Validate important assumptions fast.
Feedback	Critical learning occurs on one major analyze-design-code-test loop.	Leverage multiple concurrent learning loops.
Fast feedback	The process is tolerant of late learning.	Organize workflow for fast feedback.

Topic	Plan-Driven Principle	Agile Principle
Batch size (how much work is completed before the next activity can start)	Batches are large, frequently 100%—all before any. Economies of scale should apply.	Use smaller, economically sensible batch sizes.
Inventory/work in process (WIP)	Inventory isn't part of the belief system so is not a focus.	Recognize inventory and manage it to achieve good flow.
People versus work waste	Allocate people to achieve high levels of utilization.	Focus on idle work, not idle workers.
Cost of delay	Cost of delay is rarely considered.	Always consider cost of delay.
Conformance to plan	Conformance is considered a primary means of achieving a good result.	Adapt and replan rather than conform to a plan.

Topic	Plan-Driven Principle	Agile Principle
Progress	Demonstrate progress by progressing through stages or phases.	Measure progress by validating working assets.
Centricity	Process-centric—follow the process.	Value-centric—deliver the value.
Speed	Follow the process; do things right the first time and go fast.	Go fast but never hurry.
When we get high quality	Quality comes at the end, after an extensive test-and-fix phase.	Build quality in from the beginning.
Formality (ceremony)	Formality (well-defined procedures and checkpoints)	Employ minimally sufficient ceremony.