An Early Warning System for Projects with Rolling Wave Planning Characteristics [1]

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This article aims to share a novel approach to determining which tasks are on-track, falling behind, or ahead of schedule in a project characterized, at least in part, by rolling wave planning cycles. We noticed there are few metrics methodologies applicable to projects operating in a highly entrepreneurial environment that typically does not use many of the traditional controls found in the project management literature. Whether predominantly predictive or adaptive by nature, projects in a more ambiguous and uncertain environment can lack reporting transparency and comprehensive insight for key stakeholders. Partly in response to this dynamic, we developed an approach for an "Early Warning System," which we present in this article.

Rolling Wave

Rolling wave planning is an adaptive project planning model that reflects the reality of many projects- that the project management team may not entirely understand the discrete scope, schedule, cost, risk, and quality requirements across the entirety of the project's life cycle. The Project Management Institute (2021) defines rolling wave planning as "an iterative planning method in which the work to be accomplished in the near term is planned in detail, while the work in the future is planned at a higher level." This definition is widely echoed by leading theorists in project management academia (Kerzner, 2022; Kloppenborg et al., 2019).

Rolling wave planning can apply to predictive or adaptive life cycles and is not mutually exclusive (PMI, 2021). A construction project may be largely predictive yet still have aspects of rolling wave planning. Consider the case of a custom home build in which the customer knows they want a prominent pool feature but are unsure of exactly what specifications they desire. In this case, the contractor might very well begin work (with an allowance for scope, schedule, budget, risk, and quality), knowing that details will emerge in the following months.

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The Agile construct is arguably the most extreme version of rolling wave planning. In the Agile world, product owners and scrum masters break phases into timeframes as short as 2-4 week iterations, known as "sprints" (PMI, 2021; Kerzner, 2022; Kloppenborg et al., 2019). However, not all projects have such tight planning and iteration windows. In a recent chemical research company project, iterations were as long as a year. Iterations of multiple years are not uncommon, mainly when the projects are lengthy and complex (PMI, 2017).

Rolling wave planning reflects a general uncertainty (risk) in long-term estimates related to scope, schedule, cost, risk, and quality. In risk analysis terminology, the team faces an environment where the best available long-term estimates for scope, schedule, and cost include order-of-magnitude placeholders (high uncertainty, high risk). This dynamic results in imprecise risk probability and impact values and a significant probability for unknown unknowns (black swan events). It is important to note that risks can be positive (opportunities) or negative (threats). Typical risk responses include avoiding, transferring, mitigating, accepting, researching, exploiting, sharing, or enhancing the identified risk (PMI, 2017). However, in an ambiguous environment, such proactive actions may prove difficult. In such an environment, making appropriate and prudent decisions regarding how the project should proceed long-term may prove difficult.

One solution is to break the project into a rolling wave structure with distinct phases. Project managers should identify the appropriate phasing structure, incorporate a phase gate strategy, and identify key milestones throughout the project. Project managers can use traditional planning techniques to include the maximum detail across the timeline. A rolling wave phasing structure will likely emerge in which the first phase (or two) has timely and relevant data, approaching a fully resource-loaded WBS. The rest of the plan should include milestones or level 2 activities, at a minimum. As each phase begins to wind down, the project team plans the next appropriate phase of the project. For instance, if the team is starting a five-phase project and has the equivalent of a fully resource-loaded WBS for the first two phases, we would expect to increase the detail of planning phase three around the time phase one is winding down. However, general planning activity across all phases would increase as any individual milestones are achieved.

As the team approaches a phase gate review, the team will gather, curate, and collate essential information to facilitate the" "proceed," proceed with modifications," or" "do not proceed" outputs of a phase gate review. The team should monitor and control the project from the beginning, with selected metrics and rationale for choosing them in the project management plan. However, as the phase gate approaches, it is not uncommon for teams to do a "deep dive" into their metrics.

Consider a case where the project team identifies an issue with these critical metrics (hopefully early in the initiating phase!). The team realizes their analysis of the rolling wave aspects within their project will not benefit from all traditional Agile metrics (burndown charts, velocity diagrams, epic and release burndown graphs, statistical control charts, cumulative flow, defect analysis, throughput, etc.). The rolling wave aspects of the project may also not benefit from more waterfall-based analyses, either. Techniques such as earned value management, generalized baseline variances, etc., may not be appropriate for rolling wave analysis, particularly in an entrepreneurial environment that does not utilize strict timecard usage or traditional project cost procedures (control accounts with associated WBS codes, for example).

The "Early Warning System"

In the fall of 2021, we were in just such a scenario. Tasked with planning a research and development project that seemed to strongly and naturally align with a rolling wave planning model, we quickly realized the entrepreneurial nature of the business environment presented some unique challenges and corresponding opportunities for innovation within the project management discipline. While still in the initiation phase, we concluded that very few traditional metric mechanisms could apply to our project meaningfully. However, we still needed insight into whether the discrete tasks within phases were proceeding as planned during bi-weekly standups. Thus, necessity opened the window to innovation. After reaching out to a colleague in the health management field, we began to develop a methodology unique to our needs.

We realized if we built the following construct, we could gain insight into the scope, schedule, cost, risk, and quality implications of current project work. We, therefore, built out a relatively novel approach via a formula stack we created and have continued to refine over time. We have experienced timely and meaningful insights from the formula tree below over the last eighteen months and therefore share it with the community for review. In this case, we used Smartsheet as our project management information system. The formulas below are in Smartsheet syntax.

"Days in Work" column:
=IF(Status@row = "In Progress", NETWORKDAYS([Actual Start]@row, TODAY()), "")

[This formula determines if the task is in progress, as per the "Status" column, and, if so, calculates the number of work days that the task has been in work]

"Nominal Progress" column:

=IFERROR(IF(Duration@row = 0, "M"", [Days in Work]@row / Duration@row), 0)

[This formula inserts an "M" into the column if the task is a milestone and therefore has a duration of 0; if the task is not a milestone, the formula calculates the ratio of days in work to the task's duration]

"Actual:Nominal" column:
=IFERROR([Percent Complete]@row / [Nominal Progress]@row, 0)

[This formula calculates the user's stated completion status from the "Percent Complete" column and divides it by the value in the "Nominal Progress" column, yielding the ratio of how complete a task is to how complete it should be]

"Efficiency" column:
=IF(Status@row =" "Not Started," "Gray",
IF(Status@row = "Abandoned", "Gray",
IF(Status@row = "Complete", "Gray",
IF([Actual : Nominal]@row >= 0.9, "Green",
IF([Actual : Nominal]@row >= 0.75, "Yellow", "Red"))))

[This formula is based on a gray, green, yellow, and red stoplight symbol-formatted "Efficiency" column. If the task is showing as "Not Started," "Abandoned," or "Complete" in the "Status" column, the "Efficiency" cell appears with a gray circle in it. Otherwise, the formula will insert a green circle if the task's "Actual:Nominal" value is .9 or above, indicating work efficiency of greater than or equal to 90%, a yellow circle if the task's "Actual:Nominal" value is .75 or above, indicating work efficiency of greater than or equal to 75% but less than 90%, or a red circle if the task's "Actual:Nominal" value is below .75, indicating work efficiency of less than 75%]

Limitations: This formula stack will not automatically correct for front-loaded or back-loaded task workloads.

Required columns: Status, Actual Start, Duration, Days in Work, Nominal Progress, Actual:Nominal, Efficiency. See Figure 1 below for an example of a project plan with integrated columns for the Early Warning System (additional columns removed for formatting purposes).

Efficiency	Task Description	Status	Percent Complete	Predecessors	Actual Start	Project... Compl... Date	Durati...	Nominal Progress	Actual : Nominal	Days in Work	Assigned To
	Product Development Project	**In Progress**	**14%**		**03/25/23**	**11/10/25**	**677d**	**2%**	**790%**	**12**	
	Initiation	**In Progress**	**55%**		**03/25/23**	**05/05/23**	**30d**	**40%**	**138%**	12	
	Chartering	In Progress	55%		03/25/23	05/05/23	30d	40%	138%	12	Person 1
	~~Task 1~~	~~Complete~~	~~100%~~		~~04/10/23~~	~~04/11/23~~	~~2d~~	~~0%~~	~~0%~~		~~Person 2~~
	~~Task 2~~	~~Abandoned~~	~~100%~~		~~03/25/23~~	~~03/29/23~~	~~4d~~	~~0%~~	~~0%~~		~~Person 3~~
	Task 3	In Progress	6%		04/11/23	05/04/23	18d	6%	108%	1	Person 4
	Task 4	In Progress	60%		03/30/23	04/14/23	12d	75%	80%	9	Person 4
	Task 5	In Progress	60%		03/28/23	04/13/23	13d	85%	71%	11	Person 4
	Task 6	In Progress	85%		03/28/23	04/13/23	13d	85%	100%	11	Person 5
	Task 7	In Progress	60%		03/28/23	04/13/23	13d	85%	71%	11	Person 5
	Phase Gate Review Package Due	Not Started	60%		05/05/23	05/05/23	0	M	0%		Person 1
	Phase Gate Review (Chartering)	Not Started	0%		05/05/23	05/05/23	0	M	0%		Person 1
	Phase 1- Ideation	**Not Started**	**34%**	**12**	**05/05/23**	**11/21/23**	**141d**	**0%**	**0%**		
	Phase 2- Product Definition	**Not Started**	**25%**	**13**	**11/27/23**	**04/23/24**	**102d**	**0%**	**0%**		
	Phase 3- Prototyping	**Not Started**	**3%**	**36**	**04/24/24**	**12/10/24**	**164.5d**	**0%**	**0%**		
	Phase 4- Initial Design	**Not Started**	**0%**	**53**	**12/10/24**	**04/10/25**	**87d**	**0%**	**0%**		
	Phase 5- Validation and Testing	**Not Started**	**0%**	**83**	**04/10/25**	**08/18/25**	**92.5d**	**0%**	**0%**		
	Phase 6- Commercialization	**Not Started**	**0%**	**95**	**08/19/25**	**11/10/25**	**60d**	**0%**	**0%**		

Figure 1: Example of a simple rolling wave project plan with Early Warning System columns

We find that the ease of interpreting a filtered and sorted stoplight report during recurring standups leads to greater insight and more efficient communication among team members (see Figure 2 below). Furthermore, following a task's change in color, the conversations often lead to a greater understanding of scope, schedule, cost, risk, and quality concerns in what would otherwise be an environment of more significant ambiguity. We discovered our lessons learned register, our planning efforts, our risk register, and our overall project direction have benefited from this "Early Warning System."

Early Warning System

Efficiency	Task Name	Status	Actual Start	Projected Completion Date	Duration	Days in Work	Percent Complete	Nominal Progress	Actual : Nominal	Assigned To
	Task 5	In Progress	03/28/23	04/13/23	13d	11	60%	85%	71%	Person 4
	Task 7	In Progress	03/28/23	04/13/23	13d	11	60%	85%	71%	Person 5
	Task 4	In Progress	03/30/23	04/14/23	12d	9	60%	75%	80%	Person 4
	Task 3	In Progress	04/11/23	05/04/23	18d	1	6%	6%	108%	Person 4
	Task 6	In Progress	03/28/23	04/13/23	13d	11	85%	85%	100%	Person 5
	~~Task 1~~	~~Complete~~	~~04/10/23~~	~~04/11/23~~	~~2d~~		~~100%~~	~~0%~~	~~0%~~	~~Person 2~~
	~~Task 2~~	~~Abandoned~~	~~03/25/23~~	~~03/29/23~~	~~4d~~		~~100%~~	~~0%~~	~~0%~~	~~Person 3~~
	Phase Gate Review Package Due	Not Started	05/05/23	05/05/23	0		60%	M	0%	Person 1
	Phase Gate Review (Chartering)	Not Started	05/05/23	05/05/23	0		0%	M	0%	Person 1

Figure 2: Example Early Warning System standup report

Conclusion

In a fast-paced entrepreneurial environment, many traditional methodologies for monitoring and controlling work do not provide timely and meaningful information for projects with rolling wave characteristics. Information is data that has been analyzed and contextualized. This "Early Warning System" analyzes and contextualizes project data to provide meaningful insight to project teams, managers, sponsors, and executives. The benefits of this straightforward system include positive impacts on scope management, requirements management, schedule management, cost management, quality management, resource management, communications management, risk management, stakeholder engagement, change management, and overall integration management. Future work will include reviewing the integration of this system to communicate and manage multiple projects simultaneously.

References

Kerzner, H. (2022). *Project management: A systems approach to planning, scheduling, and controlling* (13th ed.). Hoboken, NJ: John Wiley and Sons, Inc.

Kloppenborg, T., Anantatmula, V., & Wells, K. (2019). *Contemporary project management* (4th ed.). Cengage Learning.

Project Management Institute. (2017). *A guide to the project management body of knowledge (PMBOK guide)* (6th ed.). Newtown Square, Pa: Project Management Institute

Project Management Institute. (2021). *A guide to the project management body of knowledge (PMBOK guide)* (7th ed.). Newtown Square, Pa: Project Management Institute

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