Step-by-Step
MAHD
Modified Agile for Hardware Development

The Smart Coffee Maker Project

Part 7 of a 9-part series to walk through an agile development project from concept to launch

Step 7:

Iteration One Complete

By Dorian Simpson and Gary Hinkle

A Quick Intro to MAHD

Agile methods have proven superior over traditional product developement processes to quickly adapt to customer needs, reduce waste and accelerate development. However, the application of agile requires significant changes to support the needs of hardware products. This led to the development of the Modified Agile for Hardware Development (MAHD) Framework — an open-source initiative to embrace the principles of agile while recognizing hardware's unique needs.

THE COFFEE MAKER PROJECT: STEP-BY-STEP AGILE IN NINE STEPS

To help practitioners visualize the MAHD Framework, we have developed a series of nine articles to explain how agile methods and tools can be used for physical products, who should be involved, the deliverables for each step and tips for how to overcome challenges. We hope you'll join us on this journey as JavaBrew uses the MAHD Framework to develop an innovative new coffee maker.
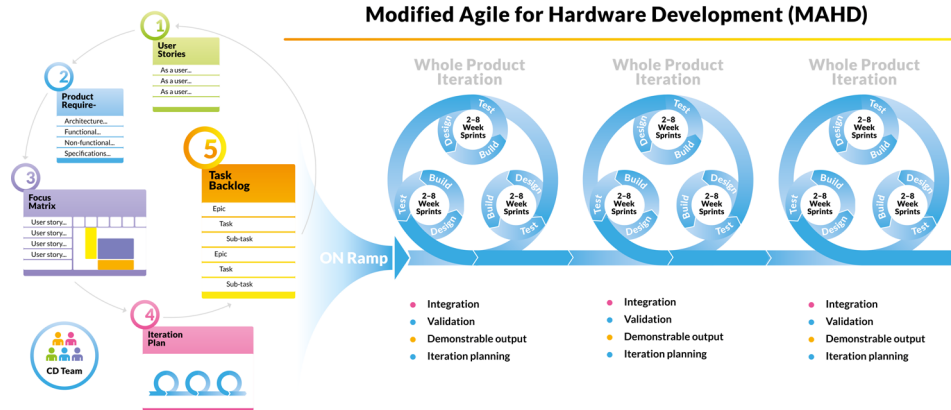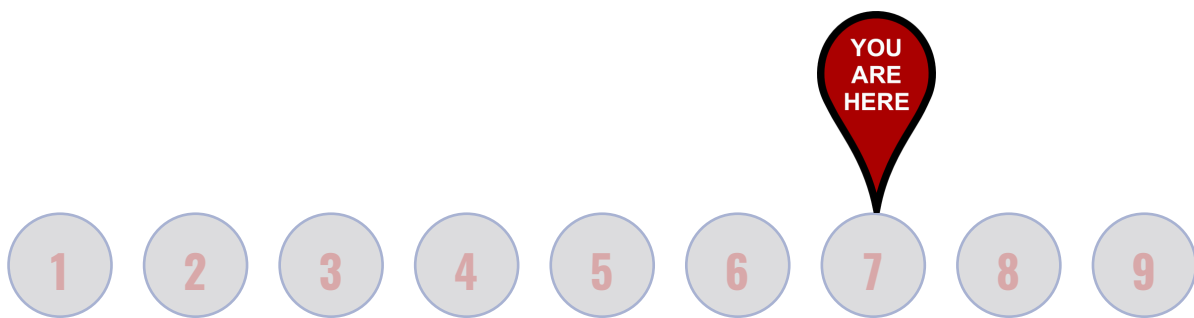
The MAHD Framework: Similar to Agile for Software, but with Important Differences

Learn More

To learn more about the MAHD Framework, download related ebooks and whitepapers, or sign up for e-learning opportunities, visit **www.agileforhardware.org.**

STEP 7: SITUATION

Step 7: JavaBrew Completes Their First Iteration

THE SITUATION

It's been ten weeks since the JavaBrew agile team started development on their new smart coffee maker and they are now competing sprint five. This also marks the completion of their first iteration — a major milestone. As you may recall, the MAHD Framework uses two levels of rapid iterations. The first level consists of short, task-based sprints, while the second, higher-level iterations focus on key project milestones, prototypes, questions and dependencies. Through each of the five previous sprints they followed the agile framework as closely as possible to pull tasks from the backlog, plan two-week sprints, validate deliverables and track progress. A lot has happened in the last 10 weeks! As the team focused on completing backlog tasks, they also had to adapt to management requests, get comfortable with uncertainty and adopt a new "agile" way of approaching projects.

It's now time to review their situation and determine if they achieved their planned Iteration 1 goals as shown here:

Prototype	Key Questions	Milestones
Preliminary Brochure	• Is the value proposition right? • Which features drive value? • Is a physical interface needed?	• Concept approved • Plan approved (including resources)

One of the major outcomes of their first sprint, as discussed in Step 6, was the need to engage with customers to hit these goals. Lynda, the Product Manager, struggled at first to identify these customers. To resolve this in Sprint 2, the whole team agreed to contribute in an unconventional way using social networking. Through their current Facebook page followers, the team identified 30 customers that match their target market who agreed to be part of JavaBrew's feedback panel. Each participant agreed to sign a non-disclosure agreement and provide candid feedback.

This customer engagement strategy worked well. In subsequent sprints, the team was able to conduct several activities to gain insight and prioritize features by using early drawings, product descriptions and customer feature voting techniques.

They learned several important things during the first iteration:

- **Coffee selection was more important than strength flexibility.** Consistency and quality were very important, but customers wanted a choice in beans when making coffee. They decided that multiple chambers for beans is desired so that users can load them with 1, 2 or 3 types of coffee. Of course, this would add complexity to the design!

- **"Smart" was generally confusing to customers.** They didn't immediately see the value of this concept since traditional coffee makers are so simple. Add beans and water. Press start.

STEP 7: ACTIVITIES

Wait. Pour. Drink. Once they understood how a connected app might work to enable new use cases to start coffee from anywhere, see progress, set timed coffee-making, etc. they loved it. However, they wanted it to *be* smart, but not *look* smart. They want an attractive design that didn't look "geeky." It was also clear that "voice control" was not desired or necessary. It was cool, but "just added complexity if it didn't work perfectly." But would JavaBrew's management agree?

It's Friday afternoon and the team has gathered in their project room ready for their sprint and iteration review. Jordan, the Agile Project Manager will facilitate the review and lead the retrospective discussion. After this meeting, they will first review their overall iteration plan then dive right into sprint planning for the next sprint.

AGILE ACTIVITIES

For Step 7, the team must engage in two separate reviews. Jordan explains the goals:

1. Review iteration 1 goals and progress against each one.
2. Review the overall iteration plan for the project and clarify goals for iteration 2.
3. Plan for the next sprint.

To kick off the discussion, Jordan first shares the overall project goals as shown in Figure 1 that was developed during the project kickoff in Step 1.

Iteration Review and Planning:

They then review the status and next steps for each iteration milestone and key question:

1. **Preliminary Brochure?** Successfully completed and used to gain valuable customer feedback.

2. **Is the value proposition right?** Yes! While many details remain, customers love the overall "smart" concept (once they understood the value) and they are moving in the right direction.

3. **Which features drive value?** This is mostly understood but they still need to prioritize key features such as the importance of "multiple bean options." The good news is that they believe voice control can be removed.
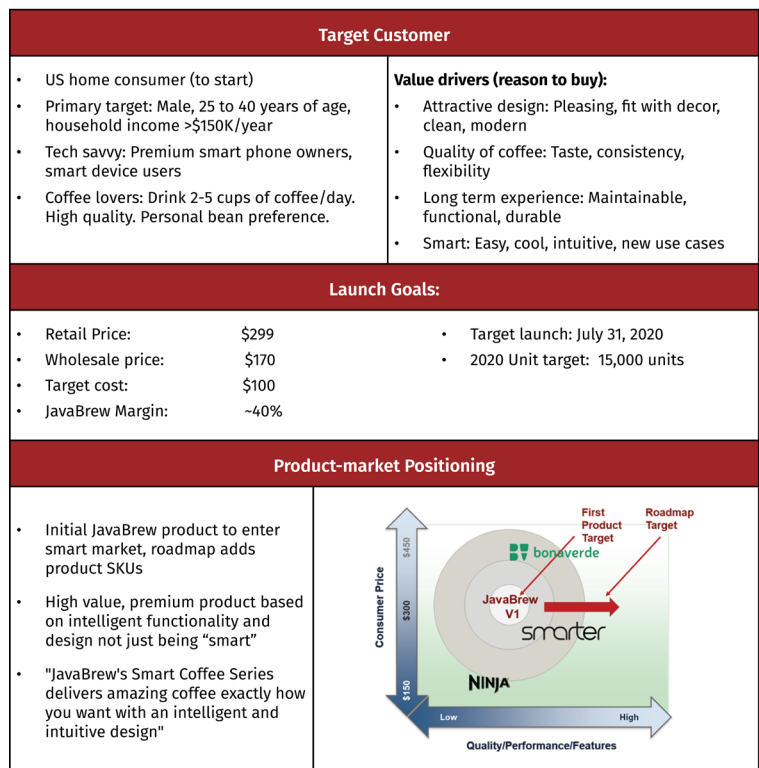
Target Customer	
• US home consumer (to start) • Primary target: Male, 25 to 40 years of age, household income >$150K/year • Tech savvy: Premium smart phone owners, smart device users • Coffee lovers: Drink 2-5 cups of coffee/day. High quality. Personal bean preference.	**Value drivers (reason to buy):** • Attractive design: Pleasing, fit with decor, clean, modern • Quality of coffee: Taste, consistency, flexibility • Long term experience: Maintainable, functional, durable • Smart: Easy, cool, intuitive, new use cases

Launch Goals:	
• Retail Price: $299 • Wholesale price: $170 • Target cost: $100 • JavaBrew Margin: ~40%	• Target launch: July 31, 2020 • 2020 Unit target: 15,000 units

Product-market Positioning	
• Initial JavaBrew product to enter smart market, roadmap adds product SKUs • High value, premium product based on intelligent functionality and design not just being "smart" • "JavaBrew's Smart Coffee Series delivers amazing coffee exactly how you want with an intelligent and intuitive design"	

Figure 1: Project Goals from Step 1

STEP 7: CONFLICT

4. **Is a physical interface needed?** Customers don't need this if it's "smart."

5. **Concept approved?** Not yet. They have a good working concept, but questions remain.

6. **Plan approved (including resources)?** Almost. They need to review the overall concept and P&L with management, but they believe this will be no problem.

Iteration 2 Planning:

The kickoff for planning their next iteration started with Frank, JavaBrew's head of Design and Mechanical Engineering. He has analyzed the manufacturing cost with the finance team as the product is now defined and is very concerned. The team doesn't see how they'll be close enough to the target cost to get management approval. If they add the desired "multiple bean options" feature that customers want, they realize they need design innovation to reduce cost while maintaining design for manufacturability. Iteration 2 must tackle this! They absolutely must eliminate the physical interface to meet the target cost. Customers were OK with this, but so far, management is uncomfortable with this path. The team spends a few minutes brainstorming solutions, they decide to move forward with the concept with no physical customer interface and verify with their customer panel by getting feedback from their 3D animation and their smart app prototype. They realize there is risk if customers don't agree and management pushes back, but so far it seems in the right direction.

They continue to review their overall milestones, prototype plan, major questions and dependencies. They agree to keep the current iterations but refine the milestones.

Next Sprint Planning:

Once the team agrees on the update to the overall Iteration Plan and Iteration 2 goals, the team begins their normal planning for the upcoming sprint. They continue to review the top items in the backlog, estimate tasks and commit to the sprint.

CONFLICT AND RESOLUTION

In the process of getting the manufacturing cost approved, Jim, JavaBrew's VP of Engineering, doesn't like that the physical interface has been removed and isn't even convinced the "multiple bean option" should be added. He asks a good question, "Can't the multiple bean feature be included in a higher-end next-generation product?" While Jim hasn't been a part of the project's day-to-day agile team discussions, he's aware of the customer feedback so far but refuses to approve moving forward with that concept. For the physical interface, the team tries to explain that they have input from enough users who don't need it, but he isn't satisfied. He directs the team to move forward with two concepts to test – one with and one without the interface. Jordan points out that this is extra work that will set them back further. Jim argues that it will accelerate learning and shouldn't be a big deal from a design perspective.

With this official direction, the team is concerned, but soon realizes that making a 3D animated video showing both versions won't be much additional work, and they easily come up with a slick way to get input on the multiple design concepts. The video will also demonstrate the prototype smart phone app, which they think is simple and looks clean — exactly their goal. They also agree to further understand the importance of a multiple bean feature. Jim may be right and it could be removed and added to the next generation product.

STEP 7: OUTCOMES/NEXT STEPS

OUTCOMES

The outcomes from step 7 were as follows:

Outcome 1: An Updated Iteration Two

They team updated their overall Iteration Plan with a revised Iteration 2 as shown in Exhibit 1.

Outcome 2: A Learning Directive

It wasn't only Jim that had questions about the physical interface and multiple bean feature. If the team was to have a solid product that had the acceptance of all stakeholders — customers, retailers and management — they knew they needed ongoing customer feedback as they refined the product. These were big decisions that needed to be made quickly.

NEXT STEPS

After having a full iteration behind them, the JavaBrew team will continue to complete sprints every two weeks, revise the Iteration Plan as needed and keep resolving conflicts as they arise. In Step 8, we'll jump forward several iterations until the team is almost ready to start production and enter the market. Were they be able to stay on schedule? Who won the war of the physical interface and how many other compromises did they need to make to hit their target date?

AUTHORS' NOTE

If you've come this far on our step-by-step journey, you may be wondering, "How exactly is JavaBrew's agile approach really different from traditional project management?" While we have attempted to clarify this throughout our steps, it may not be obvious if you haven't seen a project unfold in real-time. The following table highlights several key project success attributes and how agile differs. The bottom line is that agile projects start faster, learn faster and adjust faster to new information.

	Traditional Project	Agile Project
Time Frame - Start	2-4 months to start	2-3 weeks to start
Project Refinement	6-9 months before big questions arise and refined after major crisis points	4-6 weeks before big questions arise and continuously refined
Functional Collaboration	Eventually	From Day 1
Customer Engagement and Learning	After 80% of project complete (too late to take seriously)	Built in to the process (used to redirect quickly)
Executive Engagement	Before project begins and after big problems identified late in the schedule	Throughout
Schedule	Gantt Chart: Months to develop (it's wrong - PM updated)	Iteration Plan: Hours to develop (it's a target - team updated)
Project Tracking	Weekly PM Update "On schedule"! (Until it's obvious you're not)	Sprint Update "Our % of completion" (Updated as project evolves)

Exhibit 1: Updated Iteration Plan

Iteration 2 Plan: Updated to show a renewed focus on answering critical product questions.

EXHIBIT 1

	Currently Planned Iteration 2	**Updated Iteration 2**
Major Deliverables	• Cost estimates, initial industrial design, electronics design • Smart features defined – app/voice	• Cost estimates • Initial industrial design options (with and w/o physical interface) • Preliminary electronics design • Smart features defined – app
Prototypes	• 3D video highlighting smart features and ease of use	• 3D video highlighting smart features, physical interface options, multiple bean option and ease of use
Key Questions	• Value of voice control? • App features? • Can cost meet targets?	• App features? • Can cost meet targets? (with multiple bean option) • Is physical interface needed? • Is multiple bean option needed?
Milestones/ Approvals?	• Cost estimates approved	• Cost estimates approved • Value proposition approved • Product definition approved
Risk Mitigation	• Schedule risk – team velocity on target? • FCC compliance	• Schedule risk – team velocity on target? • FCC compliance
Target Date	5/24/19	5/24/19
# of Sprints	3	3

To Be Continued...

GET THE SERIES

To see the previous steps and receive each new step of this project as it is published, visit **www.AgileForHardware.org**. Each step will be available for download and sent directly to your email.

ABOUT THE AUTHORS

The MAHD framework is an open-source process, available for all to use, build on and improve. We look forward to hearing from you and your experiences with agile, waterfall and other processes. The MAHD framework was developed by Gary Hinkle and Dorian Simpson to address the needs of hardware development.

To learn more, get involved, or just join our community for discussion, visit:

www.AgileforHardware.org

About Gary Hinkle

Electronics, mechanical and software engineering are all part of Gary Hinkle's background, working in design, management and executive leadership of communication, industrial, telemetry, audio, avionics, computers, test & measurement, among other industries. Today, he's principal consultant at Auxilium, a company he founded to help engineering-oriented businesses increase productivity.

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Dorian Simpson is an innovation and product development consultant, trainer, speaker and author of *The Savvy Corporate Innovator*. Companies he's worked with include ABB, Tyco, Owens Corning, Technicolor, FEI, VTech and Freightliner. Before consulting, Dorian held positions at Motorola and AT&T in product management, sales, marketing, business development, and engineering.

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