THE MINE DIGITIZATION BLUEPRINT

A PLAYBOOK TO DEPLOY TECHNOLOGY TO RUN SAFER AND
MAKE MORE MONEY

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# Table of Contents

1. WHY DIGITIZE? ................................................................................................................................. 4
   - The mining productivity gap .................................................................................................................. 5
   - Serious savings ..................................................................................................................................... 8
   - Low-hanging fruit: Forms & conventional maintenance ........................................................................ 12
   - Stepping it up: Short interval control & the Internet of Things ............................................................. 14
   - Going for gold: Autonomous vehicles & predictive maintenance ....................................................... 16
   - Looking back at the OEE and Personnel Utilization ........................................................................... 18

2. TAKING STOCK ..................................................................................................................................... 19
   - Step 1: Map Mine Leadership ............................................................................................................... 20
   - Step 2: Create a Core Digitization Team (Tiger Team) ...................................................................... 21
   - Step 3: Get Buy-In from Management ................................................................................................ 21
   - Step 4: Building the “Customer Voice” Team .................................................................................... 23
   - Step 5: Big Rocks to Tackle ................................................................................................................ 28
   - Step 6: Creating a Vision .................................................................................................................... 28
   - Step 7: Create a Communication Plan ................................................................................................ 29

4. LEVEL 1 DIGITIZATION: FORMS ..................................................................................................... 32
   - Collecting Forms and Noting How They are Processed ........................................................................ 33
   - What to do With Your List .................................................................................................................... 34

5. LEVEL 2 DIGITIZATION: MOBILE MAINTENANCE ........................................................................ 35
   - Getting the Lay of the Land .................................................................................................................. 36
   - Does Your Software Do This? .............................................................................................................. 37

6. LEVEL 3 DIGITIZATION: SHORT INTERVAL CONTROL (SIC) ......................................................... 39
   - Looking at Present Solutions ................................................................................................................ 40
   - Evaluating New Solutions .................................................................................................................... 41

7. TRYING IT OUT .................................................................................................................................... 44
   - Short Term Wins ................................................................................................................................... 45
   - Integrating Trial Software Into Existing Systems and Testing it Out - Days 2 and 3 ......................... 46
   - Building on Change and Making it Stick - Day 4 ................................................................................ 47

8. MANAGING CHANGE .......................................................................................................................... 49
   - Overview .............................................................................................................................................. 50
   - Project Plan ......................................................................................................................................... 52
Foreword

This book is the result of our experience with helping world-class mines digitize their operations. As a builder of apps and platforms that enable mines to run safer and more profitably, we bring you an honest perspective rooted in ground reality. You won’t see any fluff in this book - it’s not worth your time to read, or our time to write.

“Digitization” is a buzzword that’s like the flu - it seems to be everywhere at once, everyone seems to have come in contact with it, and no one's really immune to it.

But, unlike the flu, digitization done right has some real benefits. The challenge is in knowing what those benefits look like for you, knowing where to start, and serving as a ready reference in the future - all while cutting through the noise. That’s what this book will do for you.

What won’t this book do?

It won’t solve your people issues - but it will list steps to help get your team on board.

It won’t discuss specific mining methods - but it will bring to your attention how digitization is changing the way you and your competitors mine.

It won’t give you answers for expenditure and return on investment down to the last dollar but it will give you a pretty good sense of those numbers for your mine.

Enough grandstanding. Thanks for buying this book. Let’s get to work.
Why Digitize?

“Only the paranoid survive”

Andy Grove, former CEO of Intel
(a $200B+ company that powers our digital lives)
The Mining Productivity Gap

Let’s start at the top. What’s the most fundamental business objective of a mine?

It’s to maximize the overall net present value of an ore body. In other words, mine management needs to ensure that the revenues generated by the site are as high as possible, for as long as possible.

This generally translates into maximizing the mining rate, which involves minimizing inefficiencies of every kind. Because things move so fast, a mine needs to empower its front-line supervisors and operators with up-to-the-minute information that they can utilize to make near-real time decisions to streamline operations based on equipment and personnel availability -- while also providing its team members with a safe working environment.

As great as that may sound, here’s the truth: Mining has a lot work to do to get there. At the SME 2014 keynote, Dean Gehrig said, “...mining is 30 years behind oil & gas in using technology to streamline operations”. There’s been some progress over these past four years, but there’s still a lot of room for improvement.

Let’s go deeper.

An operational mine tracks three key productivity metrics:

- Haulage: How many tons of ore did we move out of the headings?
- Overall Equipment Effectiveness (OEE): What proportion of my equipment is available for duty as opposed to being in the shop for planned or unplanned maintenance? Of the available pieces of equipment, for how long were each of them operational as opposed to being idle?
- Optimal Heading Serviceability: What is my ratio of open headings to resources available to work on those headings? If my team can’t cover all open headings, we’re spending money to keep unproductive headings open. If there aren’t enough open headings, my team and equipment are being underutilized.
A study by McKinsey & Company, a consulting firm, found that there has been a sustained decrease in mining company productivity during the period 2004-2013 (see chart; consider this a proxy for haulage and heading serviceability). Anecdotal information suggests that this trend has been continuing from 2013 to today as well. What do you see at your mine?

Note that this trend appears to be independent of global economic conditions (booms, recessions, etc.). That’s good to keep in mind in case someone tells you that “the market is doing great, so we don't need to worry about it.”

**Mining labor productivity in Australia declined by roughly 50% since 2001**

Source: Australian Bureau of Statistics
When it comes to OEE, mining is well behind other industries that have somewhat similar workflows (oil & gas, manufacturing). We’re talking OEE in the 25-40% range in our industry vs. 85-95% in those other industries. One could say that’s because “our industry is different”, “we have unique circumstances”, etc. But let’s be blunt. That’s a cop-out. We can do better.

Fig. 1.1: Mining productivity gap graph
Serious Savings

Over the past five years, digital technologies have transformed our personal lives. And today, they’re transforming our industry.

In the sections that follow, we’ll talk about the benefits of going digital, and explain:

- The cost savings and revenue increases your company can see.
- How going digital is driving results for your peers and your competitors.
- How to identify your current digital readiness level.
- How to get to your promised land in a cost effective manner.
- How we can help your company set the stage for serious long-term benefits.

Let’s start with the savings.

Every day, our industry sees huge amounts of non-productive time, due to planning or dispatching issues, operator error, or equipment malfunction. All of this costs money. Throw in accidents and perhaps an MSHA fine or two, and the tab becomes even higher. Poor dispatching can lead to needless waiting in line; an operator’s next task on their printed lineout can easily become outdated, impossible, or unsafe. All of this leads to expensive downtime and more.

Check out the scenarios below. Do they sound familiar?

1. **An underground shifter needs to go back to surface to get the latest cut-sheets because Geology updates the file at 9:00 am**

   ~250,000 lost per year in unproductive travel from underground to surface and back.
Those are some big numbers. Think of the human and dollar value of keeping your team safe and productive by minimizing these losses. That’s what digital can do for you. Curious what these numbers add up to for each software type? The table below should give you a good idea.

Let’s do a quick calculation for your specific mine.

Please treat the following chart as a worksheet. We do have a calculator online that you could use (or download as an excel file) at http://mineDigitization.com. If you need help, please refer to Appendix A to see a sample underground Gold mine.
### Sources of loses in table

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<th></th>
<th>Number</th>
<th>Avg. Cost Per Item</th>
<th>Total Cost Per Year</th>
<th>Notes</th>
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<td># of MSHA inspections in a year (manging time)</td>
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<td># of MSHA citations in a year</td>
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<td>Staff responsible for data entry (geology, survey, environmental, MSHA, haulage, inventory)</td>
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<td>Supervisors/shifters going back and forth to office to get updated data (cut-sheets, vent maps, etc.)</td>
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<tr>
<td>Expected savings with form digitization</td>
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<td>Average # of equipment breakdowns in a week</td>
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<td>Average # of preventable breakdowns in a week</td>
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<td>Average # of days in the workshop for equipment</td>
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<td>Average number of days waiting for parts for equipment repairs</td>
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<td>Expected savings with proactive mobile maintenance</td>
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<td># of equipment at your mine</td>
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<td>Average cost per employee</td>
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<td>Average time spent during shift change</td>
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<td>Average # of tasks for an operator in a day</td>
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<tr>
<td>Average time spent locating equipment at shift change</td>
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<td>Average number of times worksite is not ready when operator arrives (no loader, flooded, etc.)</td>
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And the savings don’t have to end here. There are many promising new technical solutions coming out in mining, and it’s important to make sure that your organization gets the most for its money. Here’s a chart showing several digital technologies being used in mining. As you go from left to right, the cost increases. As you go from bottom to top, you get better return on your investment (ROI).
Low-Hanging Fruit: Forms & Conventional Maintenance

Digitizing your forms and conventional maintenance activities are “low-hanging fruit” that can be quickly deployed at your mine.
“Digital forms” refers to the conversion of all of your paper-based forms into digital format for use by operators on a smartphone or tablet in the field. “Digital conventional maintenance” refers to the use of digital forms, along with validations, throughout the sequence of activities associated with the conventional maintenance of equipment.

Each of these solutions is relatively quick to implement (days for forms, weeks for maintenance), generally don’t require a massive investment of resources (forms are especially easy and can often cost less than a laptop upgrade for your team), and require very little training (likely about 15 minutes for forms, 45 minutes for maintenance) if the hardware is already in place.

We’ll take a look at Forms in Chapter 4, and Maintenance in Chapter 5.

Conventional maintenance refers to the longstanding method of planned maintenance where equipment is brought in at fixed intervals of engine hours, miles, or other metric on a rule-of-thumb basis.

This is different from predictive maintenance, where equipment is brought in only when a sophisticated computer system onboard the vehicle indicates that it’s time to take the piece of equipment in for specific maintenance items. We’ll take a look at predictive maintenance in the section titled “Going for gold” a few pages ahead.
Stepping it Up: Short Interval Control & the Internet of Things

Short Interval Control (SIC) and the Internet of Things (IoT) are solutions and technologies that take things up a notch or two relative to digital conventional maintenance, and especially relative to digital forms. Both SIC and IoT can significantly increase the utilization of personnel and equipment help you haul more ore with the same (or even lower) quantity of labor and equipment. These are proven technologies and have been in use for about a decade or so at certain mines.
“Short interval control” (SIC) refers to the process of dividing up a shift into “short intervals” of roughly 10 or 15 minutes each, then using the data captured within that interval to “control” subsequent actions in the shift. Because it works very well in practice, SIC has long been a mainstay of the manufacturing industry, and is now making its way through the mining industry. We expect some form of SIC to be implemented at major mines worldwide within the next 24 to 36 months.

The Internet of Things (IoT) is a term that describes sensors, networks, devices, and powerful computers working together to capture, analyze, and intelligently react to data in a semi-automated or automated manner. While it’s doesn’t directly refer to a specific business problem, various IoT components are being introduced into the market at an astonishing pace relative to even a few years ago.

Digital initiatives involving SIC and/or IoT are more involved than forms or conventional maintenance. They require greater time to deploy, more time to pilot, and more time to train. We’re talking anywhere from 2-6 months, depending on the specific circumstances at your mine, and costs in the mid-six figures are not unheard of. However, done right, they can pay for themselves many times over and set your mine up for sustained success. You’d do well to take a closer look at them.

We’ll take a closer look at SIC in Chapter 6.
Radical transformations will forever change the way we mine. Billions of research dollars are being spent to minimize the amount of time that people need to be present in active mining areas, in order to maximize safety and productivity.
“Predictive maintenance” can be thought of as the process of performing maintenance on a piece of equipment only when needed, and based on an accurate understanding of the level of wear on its components. Optimizing maintenance is critical: on the one hand, we never want a catastrophic failure in the field, but on the other, we have to keep in mind the significant opportunity costs associated with taking a piece of equipment out of production more than needed, as well as the costs associated with purchase and upkeep of standby equipment.

Autonomous vehicles -- essentially, vehicles without a human driver at the wheel or even to tell them what to do -- promise to greatly improve safety via the elimination of accidents arising from human error, and productivity via the ability to run continually and take programmed breaks only when it makes sense to do so given the status of other dependent activities happening within the mine.

As you read about these technologies, you may be thinking: “Yeah, right. That’ll be the day.” And that’s a reasonable conclusion if all we’re looking at is what’s in our mines today. Relatively speaking though, these technologies are at a whole different level. It’s going to be at least 5 years, perhaps closer to 10 years, before we see widespread adoption of these technologies. But when they come, they’ll hit the industry like a tidal wave in terms of ROI (and -- let’s be honest -- in terms of their high initial cost as well). The smart thing to do right now would be to stay on top of developments in these areas, particularly if you’re responsible for any mines expected to come online around the year 2025.
Looking back at the OEE and Personnel Utilization

Do you remember a few chapters ago when we had taken a swipe at Overall Equipment Effectiveness (OEE) and pointed out how much mining needs to catch up relative to industries such as construction and oil & gas?

The good news is that, using just the digital transformation methods and examples in the book, you should be able to give those other industries a pretty good run for their money. The graph below shows this. On the extreme left, the brown bar shows the existing OEE across mining. If you now add in the productivity improvements due to digital maintenance, you can increase OEE by as much as 20 percentage points. If you take the next step and commit to short interval control, you may see OEE improve by as much as another 35 percentage points.
Taking Stock

“It is not by muscle, speed, or physical dexterity that great things are achieved, but by reflection, force of character, and judgment”

Cicero, ancient Roman statesman
So far, we've learned about the benefits that doing digital right can bring you and your mine, both in terms of safety and cost reductions.

In this section we will go over how to create a sense of urgency at your mine, how a transformation team can explain what's going on and why, and how to look ahead at any technical obstacles you might encounter.

If you create a sense of unity against a shared threat, it will give everyone permission to drop any tasks or processes that aren't helping with this goal. But the first thing you’ll need to do is to understand who the decision makers are, and who the influencers are to transform the mine into a lean, mean digital machine.

**Step 1: Map Mine Leadership**

As a first step, map out the leadership of the mine. If you wish to do this across all of your sites, please download our template at [http://mineDigitization.com](http://mineDigitization.com)
One you have identified the leadership team, the next step is to convene a meeting to create a sense of urgency to go digital.

**Step 2: Create a Core Digitization Team (Tiger Team)**

Identify about 2-3 key individuals that have previously expressed interest in streamlining how things are done at the mine -- especially people that have said “I wished there was an app for that”. Remember, these key individuals will be crucial to the success (or failure) on your journey to go digital.

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<tr>
<th>NAME</th>
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**Step 3: Get Buy-In from Management**

Any digitization strategy is generally successful if it receives support from mine management and corporate. So, to do that, you will need to present a compelling case for digitization. No matter how digital or ready to change your organization already is, an important part of building the best solution is getting buy-in instead of resistance.

There are multiple resources to help you prepare for the meeting. The authors maintain a list of good reference resources at [http://minePlaybook/technologyLinks.html](http://minePlaybook/technologyLinks.html).
Here is a checklist that will help you prepare for the meeting:

**Company:**

1. Complete mine org structure
2. Pick influencers that share your digital version

**Arm yourself with data:**

1. Get up to speed on latest in technology (in mining)
2. Get up to speed on latest in technology (outside mining)
3. Speak to people at companies that have done it before (check with authors)

**Do some homework**

1. Identify 3 focus areas for Digital (e.g. Inspections, Water Quality, Production Ops)
2. Quick research into solutions for those 3 focus areas for Digital

**Schedule meeting**

1. Pick attendees: 3 to 4 senior mine management, 1 to 2 at corporate, 1 to 2 in IT
2. Set objective of meeting (Decide: Go digital? Or what do we need to do to go digital?)
3. Send meeting invite
Step 4: Building the “Customer Voice” Team

The next steps are to define a vision – but to do that, you should first understand the pain points within the organization, and then help craft a vision around digitizing that. To get miners to adopt new ways of doing things is like trying to teach a dog new tricks (or herding cats). We’re all human, and resisting change comes naturally to us. If that resistance isn’t acknowledged and harnessed, the road ahead can be more difficult than it needs to be.

Empower the most involved end-users (operators, supervisors, maintenance, tech services, etc.) to ask as many questions as they want. It’s important to assure them (and yourself) that a proposed digital solution is actually an improvement to the way things are done today. This will help ensure that the end-users have true ownership over the process. It’ll make deployment easier, and get you to your results faster. To that end, identify people that will help the Tiger Team brainstorm answers to the following:

**At the meeting:**

1. Outline Current State
2. Present vision for where we need to be
3. Present research
4. Present potential ROI
5. Present potential Costs

**Goal:**

1. Go/No-Go to decision to explore further
2. Confirm structure of “Tiger Team”
Who would see things from the operators angle?

Who in IT could tell you if this system will integrate?

Who deals with MSHA?

Who does repairs?

Who deals with dispatching?

Who tells miners what to work on next without giving confusing or contradictory directions?

Who can help sell this idea to the teams? Perhaps someone well-regarded?
## IT inventory

<table>
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<tr>
<th>Site Survey</th>
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<th>Some</th>
<th>Yes</th>
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<td>Do you have open pit/surface operations?</td>
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<td>Do you have underground operations?</td>
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<td>Do your sites have a Control Room?</td>
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<td>Do your sites have a Dispatch Room?</td>
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<td>Does your mine have a back office ops on site?</td>
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<tr>
<td>Do your sites have a dedicated shift change/line out area?</td>
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## Site Connectivity

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<td>Do your sites have cell phone connectivity?</td>
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<tr>
<td>Do your sites have internet connectivity?</td>
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<td>Do your sites have WiFi?</td>
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<td>Do you separate Corporate WiFi from Guest WiFi?</td>
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<td>Do you have WiFi in your Underground Mine?</td>
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<tr>
<td>Do your sites have a dedicated shift change/line out area?</td>
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## Mining tool inventory

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<th></th>
<th>Paper Based</th>
<th>Excel / Word</th>
<th>Desktop / Web</th>
<th>Mobile App</th>
<th>Name of Software (if any)</th>
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<td>Master data/management</td>
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<td>Mine planning</td>
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<td>Mine scheduling</td>
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<td>Geology</td>
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<td>Survey</td>
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<td>Long range planning</td>
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<td>Short interval shift planning</td>
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<td>Crew availability and rotations</td>
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<td>Dispatch system</td>
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<td>Worksite inspections</td>
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<td>Equipment inspections</td>
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<td>Fleet management system</td>
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<td>Heading lifecycle management</td>
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<td>Haulage tracking</td>
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<td>Delay code management</td>
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<td>Shift pass downs</td>
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<td>Haulage count / ore count</td>
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<td>Production control</td>
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<tr>
<td>Shift logs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equipment tracking</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Performance scorecards</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Asset management</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Workorder management</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Compliance management</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inventory management</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long term consumables</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short term consumables</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Blasting</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Training management</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Ventilation and heating</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enterprise historian</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade control</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
Step 5: Big Rocks to Tackle

Once the team is in place, creating a vision is important. We'll tackle that in the next section. Right now, with the freshly-minted Tiger Team in place, a key objective should be to discuss tangible issues that the team members would like to soon-to-be digital mine to address.

We call this the “Big Rocks to Tackle” discussion. That’s because once these big rocks are on the table, they serve as a useful reference point in the future for why a particular vision statement was crafted a certain way, or why a particular approach is being taken for a digital solution. Some tips to consider while having this discussion:

- Ensure that every team member contributes at least three unique, major problems that they've encountered in their work over the past year and would like to see solved
- Place these problems into categories that make sense to you and the team
- Assign names to these categories

You may find as you do this exercise, that some problems may have their own category, and others may fall into more than one category. That’s OK, in fact, it might be valuable information for later down the line, when you develop digital solutions.

Step 6: Creating a Vision

Now that the right team is together, and you have a few concrete examples that the team feels strongly about addressing, you have the building blocks for creating a meaningful vision statement. If you don’t engage your team, you are very likely to come up with a vision that doesn’t account for seemingly obvious factors in the field. That could lead to inefficiencies and possibly even backpedaling on your plans.
A couple of key points:

- The vision statement cannot be a vague or empty-sounding. It should hit close to home in a positive way. Otherwise it’s wasting the time of the team who wrote it and of everyone asked to follow it.
- Don’t let momentum die by delaying creating of the vision statement. If actions aren’t taken promptly, people may begin to assume that this change must not be so urgent after all. The best time to create this statement is within a day of assembling your team.

Once your team has vetted and is ready to move forward with the new vision, spread the word. People won’t have any idea that they should change the way they are working or why they should change unless they are told and the rationale is explained. Develop FAQs, keep them accessible, and be ready for the questions that will come up. Listen and explain.

**Step 7: Create a Communication Plan**

Once your team has vetted and is ready to move forward with the new vision, spread the word. People won’t have any idea that they should change the way they are working or why they should change unless they are told and the rationale is explained. Develop FAQs, keep them accessible, and be ready for the questions that will come up. Listen and explain. Keep the following in mind.
Keep in mind that these templates are available for download at http://mineDigitization.com.
Lastly: Identifying and Dealing with Obstacles

Once everyone feels a sense of urgency and knows about the vision, it’s important to keep an eye out for any obstacles that might raise their head. Start with the most basic: hardware and software. Take a look at your current hardware and where you want to go. Some solutions only work with certain operating systems, database configurations, etc. Discuss these obstacles with your internal digital team.

The next step is to identify a “digital partner” who can help you understand the specifics of your existing systems, and what changes will need to be made to those systems in order to accomplish your goals. This partner can be a digital solutions provider or, in some cases, a consulting firm. If you’re not sure where to start, give us a call.

A trusted, competent partner should ask you about the following. Use the following as a checklist when talking to your Digital Partner

• Your long-term goals with digital
• An inventory of all mine site devices, operating systems, and what they’re used for
• How good is the WiFi at the mine
• Software functions you currently use, and whether they’re on-premise or cloud-based
• What you’re planning on doing with all the data that could be collected through digitization
• Anything else your team finds important
Level 1 Digitization

FORMS

“A journey of a thousand miles begins with a single step”

Confucius
Collecting Forms and Noting How They are Processed

Before shredding all your old forms and going paperless, make sure that all your paper processes map to a digital equivalent. We don’t want throw the baby out with the bathwater. As a failsafe, have your team take pictures of all the forms presently in use at your mine, confirm that they’ve been stored in a secure location accessible to numerous team members, and note how you process them.

Forms may include:

1. Pre-shift equipment inspections.
2. Site Inspections
3. Environmental inspections.
4. SDS/COA.
5. Time sheets.
6. Any other unexpected paper forms your team may bring up.

Please check after you gather the following

1. Pre-shift equipment inspections.
2. Site Inspections
3. Environmental inspections.
4. SDS/COA.
5. Time sheets.
6. Any other unexpected paper forms your team may bring up.

1. formHound is rapidBizApp’s form digitization platform.
What to do With Your List

Now that your team has the list, you are ready to make sure your digital replacement does at least as much as the process you are replacing. If a software solution you’re considering doesn’t quite match with everything you do today, check with the vendor’s sales representative or with your digital partner; you might be pleasantly surprised how much complexity the software can handle. If not, it may be possible to request custom features, or at least get advice for how to integrate one last paper process into a digital solution.

Be ready to hand this information over to your software vendor when you get started -- but don’t write the check just yet (not even for formHound).  More advanced mobile maintenance or short interval control (SIC)/process optimization, such as rapidInspect and groundHog respectively, already come with these features. Depending on your roadmap and timeline, it may make sense to start on a higher tier and save money on total costs. However, this wouldn’t be a bad first step if you want to start with an easy win -- some vendors can even digitize your forms within 24-48 hours.

Digitizing paper forms is the first step in driving digitization that can help your mine run safer and make more money. It also serves as a relatively lower-risk project that you can undertake to assess your team’s readiness to go digital. Lessons learned while rolling out forms digitization initiatives can be extremely valuable down the line when you take on the bigger projects.

In this section, we will go over obstacles specific to form digitization. We’ll talk about getting ready to digitize forms by taking note of existing processes, and what to do with that information once you have it.
Level 2 Digitization

Mobile Maintenance Digitization

“A stitch in time saves nine”

Old Proverb
In this section, we will go over how to assess the present state of your mobile maintenance systems and how to rate any other digital mobile maintenance solution.

## Getting the Lay of the Land

Before going electronic, let’s look at your current system. Figure out what data you will need to go digital, and make sure that your new solution is actually an improvement. This rollout is a little more complicated and will require more collaboration with the vendor than form digitization, but you can get a head start by taking note of the following:

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>How do you presently track equipment?</td>
<td></td>
</tr>
<tr>
<td>Who consumes equipment information?</td>
<td></td>
</tr>
<tr>
<td>How do you keep track of information for MSHA?</td>
<td></td>
</tr>
<tr>
<td>What equipment names and existing information need to be digitized?</td>
<td></td>
</tr>
</tbody>
</table>
Now let’s take a look at what a complete high quality mobile maintenance system should do.

Does Your Software Do This?

Once you adopt a digital mobile maintenance platform, one of your operators can inspect a piece of equipment and those records will immediately be saved for MSHA. Even better, the appropriate follow-up maintenance task will be created automatically. The same goes for preventative maintenance inspections.

Taking this approach has to huge benefits:
(i) a lower likelihood of MSHA fines;
(ii) a reduction in preventable downtime.

When evaluating mobile maintenance systems, it is important to make sure that they offer at least the following functions:

---

### How long is maintenance taking from inspection to completion?

---

### How much is downtime costing you now?

---
1. Accepts pre-shift inspections.
2. Accepts preventative maintenance inspections.
3. Tracks and archives inspections for MSHA.
4. Tracks repair tasks and/or integrates with repair systems.
5. Returns metrics on fleet health.
6. Integrates with your ERP or core business process management software.
7. Provides analytics around activities happening on the platform, e.g., number of requests fulfilled by operator per shift, distribution of requests by equipment type, and inventory levels of parts.

Before you buy a mobile maintenance solution such as rapidInspect, note that some more advanced software solutions, such as groundHog’s SIC system, already come with these features, as well as form digitization.
Level 3 Digitization

Short Interval Control

“In preparing for battle I have always found that plans are useless, but planning is indispensable”

Dwight D. Eisenhower
In this section, we will go over evaluating existing systems and take the notes needed for a transformation. We will also evaluate what features any SIC software system should have and provide a brief overview of what SIC processes entail.

Looking at Present Solutions

Before jumping into a new solution, it’s important to look at how things currently work and make sure your new system is at least as good as the old one. Of the systems we've covered, SIC is the most complicated to implement, so be sure to keep your vendor in the loop. However, the following questions are a good starting point. Ask yourself:

- How does the control room keep an eye on who should go where?
- How are changes in circumstances handled?
- How is information presently stored for later analysis?
- Who looks at all exported information?
In the next section, we will go over how to evaluate any new SIC solution for suitability.

**Evaluating New Solutions**

How do you adapt your company's processes around a SIC model? The first step is implementing a system that will give you real-time data about a mine site and the work going on in that mine. Assuming you already have one such system picked out, make sure it does these things:

<table>
<thead>
<tr>
<th>Question</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you use a shift management system?</td>
<td></td>
</tr>
<tr>
<td>Do you have information on work at each heading?</td>
<td></td>
</tr>
<tr>
<td>Do you have a monthly plan we can translate to a shift-by-shift plan?</td>
<td></td>
</tr>
<tr>
<td>Do you gather data on present mine output for later comparison?</td>
<td></td>
</tr>
</tbody>
</table>
2. Work is tracked at each heading.

3. Supplies used are tracked.

4. A 3D mine map is incorporated.

5. Progress estimation is included.

6. Task assignment features are baked in.

7. Talks with ERP or enterprise software.

8. Has personnel and equipment location tracking.

9. Has delay code management.

10. Works online and offline

11. Has peer-to-peer/point-to-point communication.

But that’s not all a good SIC system should do. The next step is to change the workflow at a mine site so you can adapt to more frequent information. This will involve everything from making sure the dispatcher and controller know they can update work dynamically to encouraging the team to conduct SIC meetings at least twice daily. You’ll be able to keep adjusting course in a way that only real-time data could allow.
Trying it Out

“Learn to walk before you run”

Old Proverb
In this section we will go over your steps to a realistic short term win. We’ll let you know how to request a free trial, integrate it, and keep building on the change.

Short Term Wins

Short term wins boost team morale, often fix the worst impediments, and make clear to everyone that victory is possible. Set a timeline of no more than four days to deliver something tangible after identifying obstacles. It’s important to demonstrate a success while everyone is amped up and not let the energy die. Getting software like formHound set up at one mine site is a quick, early win that can pave the way for further digitizing your mines.

Requesting a Software Trial - Day 1

It can seem scary to request a free trial, but it’s more than worth it. Keep the following in mind:

Software Trial Checklist

1. Your team can simultaneously try several sites.

2. There will be a 2-3 week dip in productivity while people familiarize themselves with your system, but then look for the uptick.

3. If something seems wrong, feel free to get your money’s worth out of your sales rep rather than scrapping the whole thing. It’s completely possible that just one vital step ended up being missed and the system isn’t actually that bad.

4. If you catch a cold that cuts into your 30-day free trial, you might even be able to sweet talk an rBA salesperson into giving you an extension.
It can seem scary to request a free trial, but it’s more than worth it. Keep the following in mind:

<table>
<thead>
<tr>
<th>Request a Free Trial</th>
<th>Identify and Purchase Hardware</th>
<th>Install Software</th>
</tr>
</thead>
<tbody>
<tr>
<td>Look at and possibly try several vendors’ products</td>
<td>Follow minimum specs recommended</td>
<td>Follow installation steps</td>
</tr>
<tr>
<td>Ask about specs</td>
<td>Be sure to check with software provider</td>
<td>Loop in software company</td>
</tr>
</tbody>
</table>

**Integrating Trial Software Into Existing Systems and Testing it Out - Days 2 and 3**

The best time to try something is before you buy it, and oftentimes integrations can be one of the biggest pain points in implementing a system. If you can, try out integration while on your free trial.

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**Check Any That Apply**

1. Integrate with existing systems.
2. Integrate into enterprise software or ERP.
3. Integrate into mining-specific shift management software.
4. Integrate into the human side of the mine.
5. Train users on software.
The nice part is, if the free trial goes well and you prefer one system over another, no further steps should be needed to integrate it. You’re already done.

The most important test for software is trying it out at a location and making sure nothing goes wrong. Finally, you will train users on the software and make sure it meets their needs. From this point forward, brace yourself for feedback.

Building on Change and Making it Stick - Day 4

After your first win, the next step is to keep moving. Each small win will be better than the last, as you learn and adapt. A good long-term digital roadmap will involve keeping the software pilot in place and transforming other sites, while upgrading the software at the pilot site to something more advanced.

The last step is more of a beginning than an end. It will involve rolling out your selected software company-wide and making sure that the company never stops evolving and improving. The end goal of change management isn’t really about one change. It’s about creating a culture where change is easy and continual.
Managing Change

“It is always easier to talk about change than to make it”

Alvin Toffler
In this section, we will go over how you can use best practices for change while implementing a digital rollout and map out a realistic timeline for implementation.

**Overview**

Change management grew into a discipline because, no matter how well implemented, most changes don’t come about flawlessly. Have you known any of the following?

1. People who just can’t seem to remember the new way of doing things.
2. People who are tired after too many changes and don’t want to learn all over again.
3. People who worry about how the new system will handle X, Y, and Z.
4. People who feel left out of organizational changes/restructuring.
5. People worried about losing their job.
6. Integrates with your ERP or core business process management software.

The main purpose of change management are to speed up buy-in by leveraging a crisis, and to engage influential team members early, leading to better decision-making. The next focus is on getting an early win to boost morale and then keep building on that momentum. Let’s go through each step.²

² We will use an 8-step change management framework developed by John Kotter
1. Create Urgency
2. Form Powerful Coalition
3. Create Vision
4. Communicate Vision
5. Identify Obstacles
6. Achieve Short Term Wins
7. Build on the Change
8. Make Change Stick

Does this looking familiar? We've actually written this book around Kotter’s model and the eight steps were woven into our the digitization model. Sneaky, right? Let’s see how this all looks at the high level of a project plan.
Project Plan

What will my schedule for change look like? It should take about 14 days. See the details below.

Day 1
- Create Urgency
- Hold meeting for each shift.
- Go over the threat.
- Prove the threat as visibly as possible.
- Listen and answer questions.

Day 2
- Form Coalition
- Who would see things from the operators angle?
- Who deals with MSHA?
- Who handles dispatching / repairs?
- Who could tell you if this system will integrate?
- Who is popular that will help sell the teams?

Day 3
- Create Vision
- Address organizational problems
- Keep the vision bold but possible.
- Draft the vision with your coalition.

Day 4
- Communicate Vision
- Be sure to tell everyone the vision.
- Listen and explain.
- Keep repeating the vision in emails, posters, etc.

Comments

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________
Day 5
- Look at existing hardware / software.
- Look at existing paperwork and processes.
- Prepare for mobile maintenance.
- Prepare for SIC.
- Anything else your team suggests.

Days 6-9
- Identify and purchase hardware.
- Request free trial.
- Install software.
- Integrate with existing systems to see fit.
- Integrate into human processes

Days 10-13
- Try software and make it part of the culture.
- Train users on software.

Day 14
- Deploy to other locations.

Comments


Conclusion

Congratulations on making it to the end of the book! Here, we’ve:

1. Covered the improvements in safety and the millions of dollars in savings your mine could see by digitizing your forms, updating your workflows, going paperless, digitizing & optimizing processes, and transforming your organization to harness the power of digital.
2. Added up how much your mine could save with a variety of products.
3. Examined how to lay out a framework to determine your organization's readiness for change - and ways to catalyze it.
4. Discussed how to get started with form digitization for a quick win and, with more hand holding, how to venture into mobile maintenance and SIC integrates with your ERP or core business process management software.
5. We’ve outlined quick tips on how to get the most out of a free trial.
6. We wrapped up with a project plan of how to start implementing these changes at your mine within just 14 days.

Ready to digitize your mine? Need more information?

Give us a call either way. We take pride in our work and are happy to help out. Talk soon.
## Appendix

### How our Software Addresses Sources of Lost Productivity

<table>
<thead>
<tr>
<th>Source of Lost Productivity</th>
<th>Cost to Medium Size Gold Mine</th>
<th>Percent Savings After Digitization</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Beginner: Forms Digitization</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MSHA fines for bad inspections</td>
<td>$7,157</td>
<td></td>
</tr>
<tr>
<td>Somebody's entire job is to process paperwork</td>
<td>$50,000</td>
<td></td>
</tr>
<tr>
<td>Equipment down time due to lost inspections</td>
<td>$4,466,000</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL SAVED WITH FORMHOUND</strong></td>
<td>$4,523,157</td>
<td>-1%</td>
</tr>
<tr>
<td><strong>Intermediate: Mobile Maintenance Digitization</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All of formHound savings</td>
<td>$4,523,157</td>
<td></td>
</tr>
<tr>
<td>Expensive equipment repairs due to poor preventative maintenance (PM).</td>
<td>$200,000</td>
<td></td>
</tr>
<tr>
<td>Mine closes for a whole day due to a preventable accident</td>
<td>$12,236</td>
<td></td>
</tr>
<tr>
<td>Other equipment downtime due to more proactive preventative maintenance beyond those above</td>
<td>$17,864,000</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL SAVED WITH RAPIDINSPECT</strong></td>
<td>$22,599,392</td>
<td>-5%</td>
</tr>
<tr>
<td><strong>Advanced: Short Interval Control Digitization</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All of rapidInspect savings</td>
<td>$22,599,392</td>
<td></td>
</tr>
<tr>
<td>Workers with out-of-date tasks</td>
<td>$13,398,000</td>
<td></td>
</tr>
<tr>
<td>Lost equipment</td>
<td>$22,330,000</td>
<td></td>
</tr>
<tr>
<td>Less time is wasted returning to the surface or office to enter data or check on something</td>
<td>$75,000</td>
<td></td>
</tr>
<tr>
<td>Less time wasted on redundant data entry</td>
<td>$50,000</td>
<td></td>
</tr>
<tr>
<td>Utilization improvements observed beyond those above</td>
<td>$8,537,608</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL SAVED WITH GROUNDHOG</strong></td>
<td>$66,990,000</td>
<td>~15%</td>
</tr>
</tbody>
</table>

---

1. Assuming about two-thirds of citations are not inspection related and looking at MSHA data on mine citations https://www.msha.gov/data-reports/statistics/mine-safety-and-health-glance-fiscal-year and trying to find a normal year of fines. 2. Assuming an average salary of $32,420 per year https://www.bls.gov/oes/mining.pdf, $13,000 of employee overhead https://www.e3seriescenter.com/modern-electrical-engineering-blog/how-to-calculate-your-employees-cost-with-overhead-costs, not to mention management and corporate overhead of over 10%. 3. Assuming an uptime increase of 1% just from digitizing forms and preventing lost forms. 4. Looked at an example of a preventable $200,000 incident (probably expensive) and assume one whole mine site will at least save that amount per year https://www.honeywellprocess.com/library/marketing/whitepapers/EB-12-003-WhenEquipmentMonitoringMakesCents-ENG.pdf. 5. Daily revenue for a medium gold mine, according to insider assuming one minor accident per mine per year. 6. Assuming 4% lost mine revenue from 4% less equipment downtime for a medium-sized gold mine according to industry insider. 7. Assuming 3% of worker's time is spent chasing out-of-date tasks, we can deduct 3% from overall mine revenue. 8. Assuming 5% of worker's time is spent chasing out-of-date tasks, we can deduct 5% from overall mine revenue. 9. Assuming 3% of workers time (calculated in foot note 4) outside of times that affect revenue. 10. Assuming 2% of workers time (calculated in foot note 4) outside of times that affect revenue. 11. 38% actually observed in field but scaling back to 15% to account for management and cultural changes happening in parallel.
These days, it seems like everyone is going “digital”.

- What does that mean?
- Why should you care?
- How do you get started?

This book is a practical guide that’ll help you answer all these questions for your specific context. With checklists you can fill out and actionable steps you can take right now, we’ll have you up and running within minutes. Get started now.

Krishna “Kris” Kunam

Krishna specializes in Highly Scalable Enterprise Software Development. Some of the software he has built is still in use at various large Mines, and Mining Equipment and Aircraft Manufacturers. His team of experienced designers and developers build high impact, cost effective mobile solutions for “Hard Hat” industries such as Mining, Energy, and Construction.

Aniket Sawant

Aniket is VP of product at rapidBizApps, where he has driven development of groundHog around the SIC concept. He has a background in product management, engineering, and consulting, and specializes in Digital Transformations. Aniket holds a PhD in engineering from the University of California and an MBA from Wharton.