# Razorleaf

# HOW TO PREPARE TO BE A MODEL-BASED ENTERPRISE

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# EXECUTIVE SUMMARY

Model-based enterprise, or MBE, is a concept gaining more and more traction as organizations seek to capitalize on the digitization and digitalization they're achieving with different enterprise data management platforms. To help organizations understand the purpose and value of MBE, as well as get a sense of what your organization needs to do to succeed, Razorleaf's Vice President of Sales, Derek Neiding, sat down with two MBE experts.

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**Razorleaf**

**JONATHAN SCOTT**
**Razorleaf**
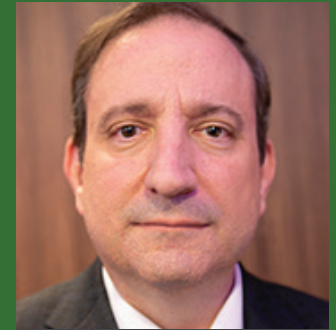
**PETER BILELLO**
**CIMdata**

Peter Bilello, President and CEO of CIMdata, addressed the what and the why of MBE, and Jonathan Scott, Razorleaf's Chief Architect, covered how to get there.

*"It's not just about digitizing things, it's about value. It's about increasing the value of your product, the value of your company."*
**Derek Neiding, Vice President of Sales, Razorleaf**

This ebook provides an overview of how any organization can take the necessary steps to become a model-based enterprise.

## TALKING ABOUT MBE

**What is Model-Based Enterprise?**

A model-based enterprise (MBE) is the pinnacle of the digital transformation process. It means full digitalization: centering your product information around a 3D model and connecting all other product and manufacturing information to that model. It also means doing away with paper entirely and passing design and information digitally within your company, as well as to suppliers and vendors. This process will be a short journey for some organizations, while others may have a lot of institutional changes to make.

Manufacturers who achieve MBE can expect to streamline development processes and improve collaboration and communication throughout the product lifecycle. MBE can result in less rework, fewer overall assembly hours, and a reduced time to market, thus yielding positive revenue growth, higher profit margins, and product cost savings.
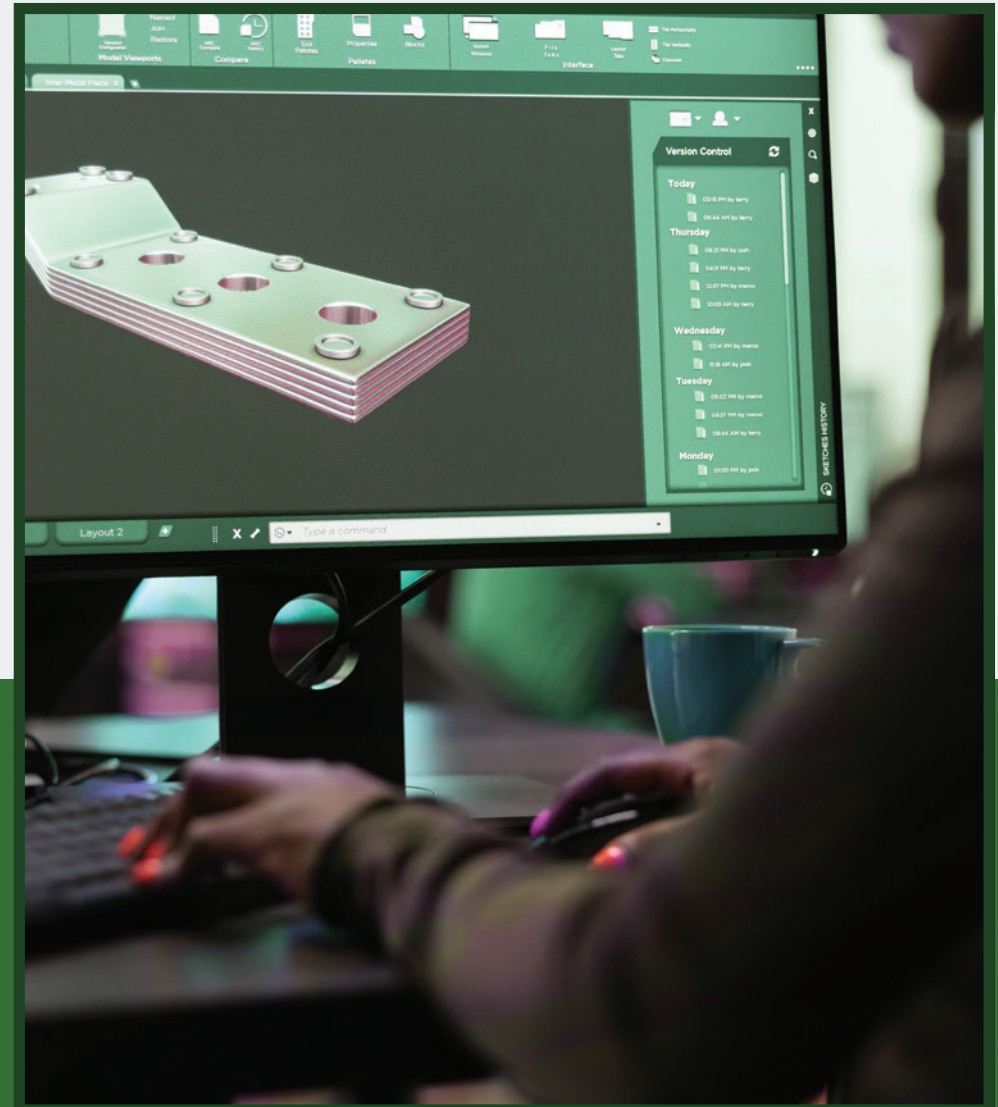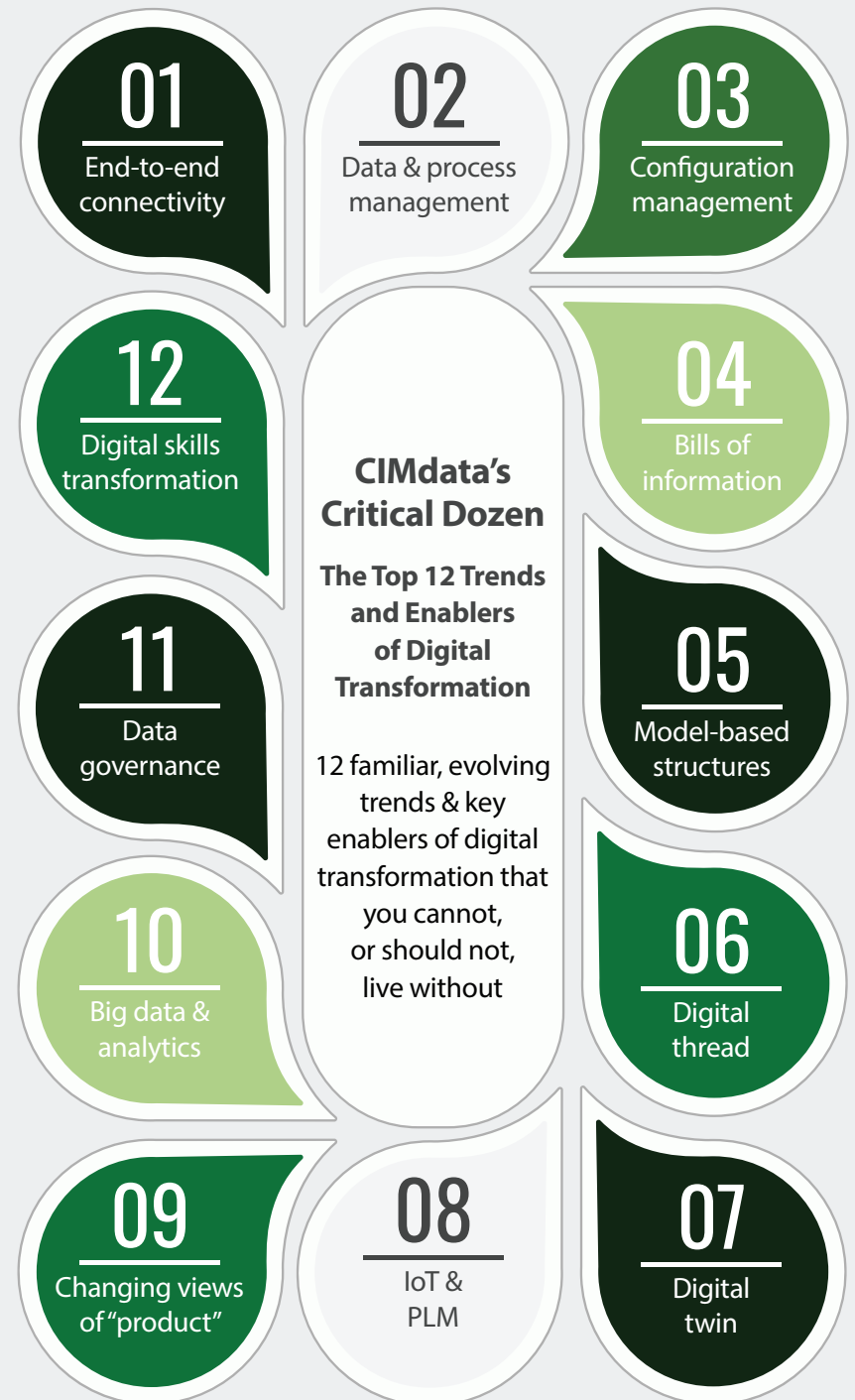
# The 12 Necessary Capabilities

CIMdata's Peter Bilello describes a set of twelve capabilities required to enable an organization's digital transformation - what CIMdata calls the "Critical Dozen." The important word there, according to Bilello, is "enable," as these capabilities aren't in order of importance. Instead, they build on each other to enable different capabilities that together allow you to achieve a digital transformation. And they're all critical.

Bilello explains, "If you do everything but step twelve, you'll miss out on opportunities because digital skills transformation is just as important as setting up end-to-end connectivity of your information structures in step one." For example, a digital thread can't exist on its own. It must be based on information models and configuration management to ensure that the information is clear, concise, and valid.

Source: CIMdata, https://www.cimdata.com

**01** End-to-end connectivity

**02** Data & process management

**03** Configuration management

**12** Digital skills transformation

**04** Bills of information

**11** Data governance

**05** Model-based structures

**10** Big data & analytics

**06** Digital thread

**09** Changing views of "product"

**08** IoT & PLM

**07** Digital twin

## CIMdata's Critical Dozen

**The Top 12 Trends and Enablers of Digital Transformation**

12 familiar, evolving trends & key enablers of digital transformation that you cannot, or should not, live without

# Digitalization: MBE's Core

**It's More Than Making Everything Digital**

The first step to realizing MBE is digitization: putting and keeping all of your information in digital files instead of paper. But it's more than having digital files, it's using them.

That's why the next step is digitalization, which starts with digital files and models as a baseline for how internal teams share information with each other and with external partners.

Finally, the more your organization embraces digitalization, the closer you get to a full digital transformation and a model-based enterprise.

**Digital transformation**

**Digitalization**
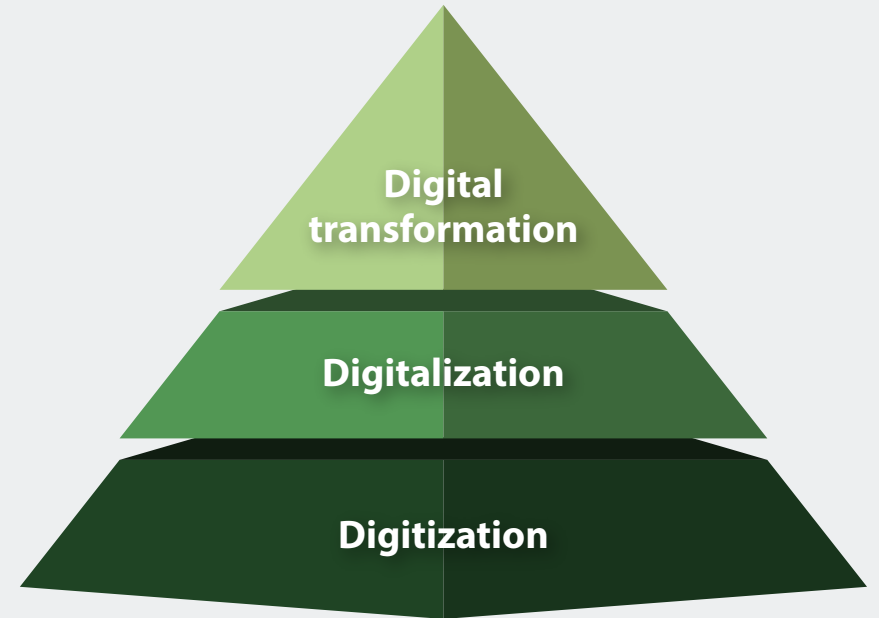
**Digitization**

**Expanding on Digitalization**

Gartner® defines digitalization as using digital technologies to change a business model and provide new revenue and value-producing opportunities. It's also the process of moving to a digital business. Inherent in those definitions, as well as in the pyramid above, is the idea that digitalization isn't only about "becoming a digital company" or digitizing products. It's also about connecting real-time data services to your models.

Most importantly, digitalization means fully appreciating the value of your information and how you build your information out and leverage it to not only be more innovative in your products and services, but also to increase ROI. Because what successful MBEs have already proven is that data speeds up innovation and product development, and in some cases, data can even become the product. The bottom line is enabling your organization to collect and connect all possible data about a product - from customer wish lists to design simulations to sales data to customer support tickets - so you can use the entirety of your product information in a way that's more powerful for your organization. That's the value of digitalization, digital transformation, and MBE.

# Models and Maturity

## What kind of models?

It's easy to think about MBE and decide that your 3D design models fulfill the requirements. But as Bilello says, "Ultimately, if you want to be a Model-Based Enterprise, there's a set of models that you need to have around product and other parts of your business." These include models that define your electronics, system architecture, and mechanical (of course). Operational models should also be connected, such as those describing logistics, manufacturing, financials, HR, and more. These are all part of a complete model-based structure that's necessary for an organization.

## How mature are they?

The gold standard for determining your institutional model maturity is the Next-Generation Model-Based Maturity Index, which is maintained by the National institute of Standards and Technology, (NIST). While this index is currently engineering-based, work is being done to expand it to a full enterprise model. But the baseline question remains the same: What's your foundation? What does your organization use as your product definition or master, 2D drawings or 3D models? That can help you determine where you are and how far you want to go with building out an MBE.

| Drawing-Centric | Model-Centric | Validated Model-Centric | Formalized Model-Based Definition | Trusted Model-Based Definition | Integrated Model-Based Enterprise | Extended Model-Based Enterprise |
|---|---|---|---|---|---|---|
| Level 0 | Level 1 | Level 2 | Level 3 | Level 4 | Level 5 | Level 6 |
| • 2D Static Drawings Only<br>• Models ad-hoc<br>• Disconnected manufacturing / disconnect enterprise | • 3D models create 2D drawings<br>• STEP AP203 derivative<br>• CAX STEP & 2D drawings<br>• Models may be managed | • 3D models create drawings & derivatives<br>• Model checked and derivative compared & managed<br>• Certificate of model quality<br>• CAX derivatives w/2D drawings<br>• Model Images | • Model-based definition (3D PMI, metadata)<br>• 3D interactive viewable<br>• 3D technical data packages<br>• Lightweight viewing<br>• MB animation<br>• MBO, derivative & CAX managed | • Model-based definition<br>• Digital manufacturing certificate<br>• LOTAR<br>• 3DW, 3D TDP, TDP deployed from PLM<br>• TDP's used<br>• Integrated mfg. | • Model-based enterprise<br>• Model-based definition w/product characteristics<br>• Auto MBO/TDP deployment to internal operation<br>• LOTAR +<br>• Integrated mfg. | • Model-based enterprise<br>• Model-based definition w/product requirements<br>• Authenticated digital exchange<br>• Auto MBO/TDP deployment to internal operation<br>• Integrated mfg. |
| File-Sharing | Doc-Centric PDM | Doc-Centric PDM | Part-Centric PLM | Part-Centric PLM | Digitally "1" PLM | Extended PLM |
| 2D Drawings Authorized | 2D Drawings Authorized | 2D Drawings Authorized | 2D Drawings Authorized | 3D Model Authorized | 3D Model Authorized | 3D Model Authorized |

Source: NIST Model-Based Enterprise Model

# Integration and the Digital Web

Two stages of CIMdata's Critical Dozen that are often goals in their own right are digital twins and digital threads. They're both integral to a digital transformation.

A digital twin is the virtual representation of a physical asset or collection of physical assets, which often exists well in advance of the actual physical asset. What's interesting is that the more connected and therefore useful the digital twin becomes - with virtual representations of a product, of its production facility and line, and even its potential services - the more the digital twin requires a digital thread. Peter Bilello stated, "A digital twin without a digital thread is an orphan."

The digital thread is a communication framework that connects data. It "sews together the different models and information structures that exist, in order to build out the full definition of the product and service you're delivering to market. It should also build from concept through life for the full lifecycle," says Bilello. He sees the digital thread as more of a digital web because the connections aren't single-point or linear. They're a series of connections and conversations.

## Integration Support is Key

Bilello points out that it's impossible to construct a digital thread without integration through systems and processes, because it's vital, for example, to connect your application lifecycle management tool to your CAD tool to your EDA tool, as well as to your IoT systems or even IIoT systems on the shop floor. All of those platforms will start with different paradigms.

He says, "This is where a good partner - one that can help you develop the right tools, capabilities, personnel and so on -is really required because you're going to have to tie together sets of capabilities and solutions."



Digital Web Example
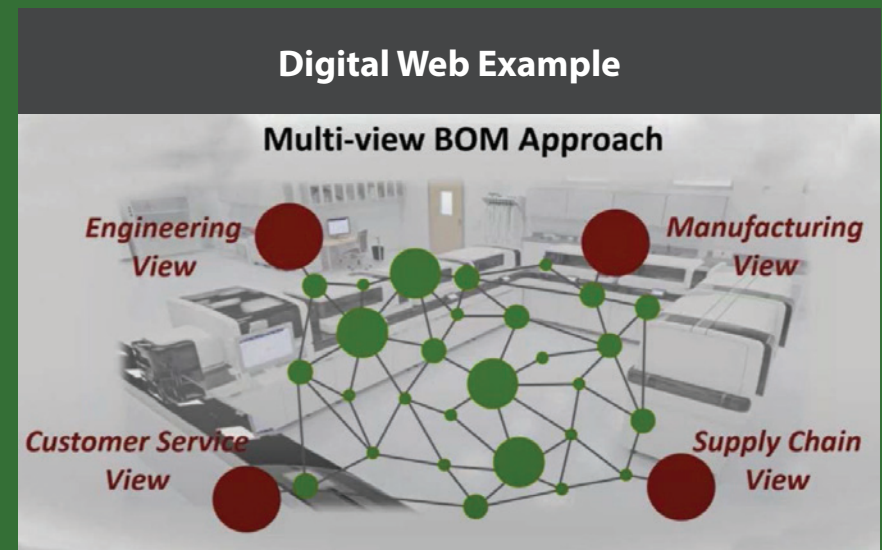
# Necessary Capabilities For Success

Razorleaf's Jonathan Scott turned the discussion from what needs to happen to become an MBE to how organizations can get there. He recommends beginning with establishing your goals, including what level of model maturity and what level of enablement in CIMdata's Critical Dozen framework you want to reach. Not everyone will be aiming for the highest level, but everyone needs to know what their target is, what you need to do to reach it, and how to add value along the way.

He identifies three specific capabilities that every organization needs to consider and build or develop in order to have any success with an MBE transformation: maturing the digital thread, exchanging and integrating data, and adapting to change.

**Maturing
the Digital Thread**

**Data Exchange
and Integration**

**Organizational
Change Management**

# Digital Thread Maturation

**Why is this important?**

While developing and maturing your digital thread is something your organization must do to create an MBE, a digital thread has inherent value whether it's part of an MBE process or not. Whether or not you plan to integrate every model and data source in use in your organization, more connected information is always going to be useful, and that's what maturing the thread is about.
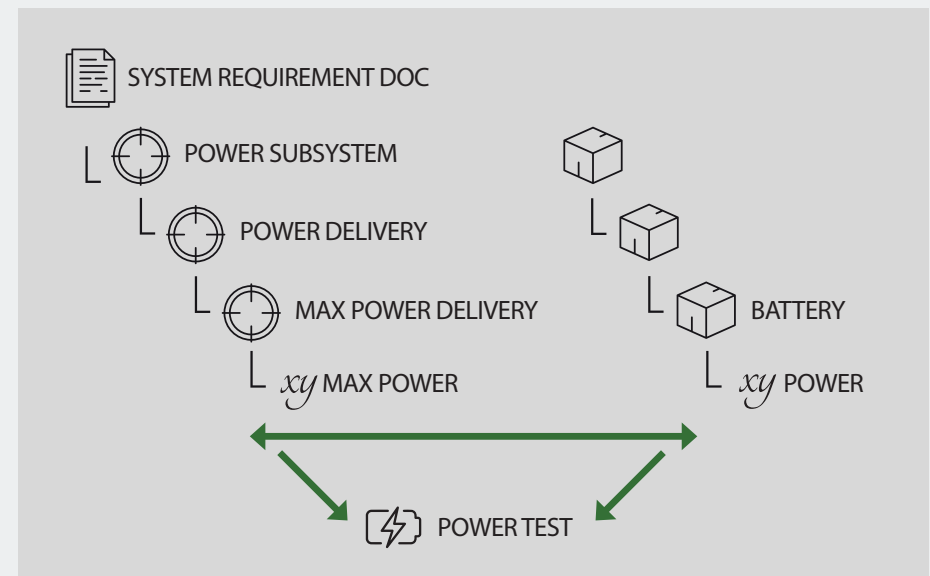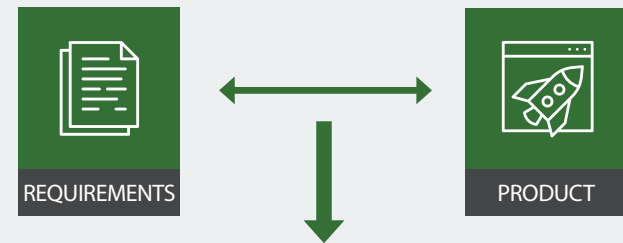
**How do you mature it?**

Add more content to the thread. Connect more pieces or sources of data (nodes) to it so that you're collecting more information about the product.

Expose more details of existing data sources, or nodes, to add granularity.

Connect sub-nodes to other sub-nodes for more strands in the thread.

Semantically enrich sub-nodes with meaning, context, definitions, or anything that will make the data more useful and "smarter."

Make use of the newly collected, rich data to improve new models and products.

REQUIREMENTS

PRODUCT

SYSTEM REQUIREMENT DOC

POWER SUBSYSTEM

POWER DELIVERY

MAX POWER DELIVERY

BATTERY

$xy$ MAX POWER

$xy$ POWER

POWER TEST

# Data Exchange and Integration

Digitalization and MBE are all about connecting data, which means crossing borders. That might mean crossing system boundaries to integrate different systems. It might mean integration plus additional needs such as translation of data formats, validation of the translation, and then integration of the modified data across groups or functions.  It could also mean crossing boundaries between organizations, such as data exchange with other companies like a supplier or design partner. Getting the data where it needs to be is easy to say and harder to implement, but it's a critical step in the MBE journey.
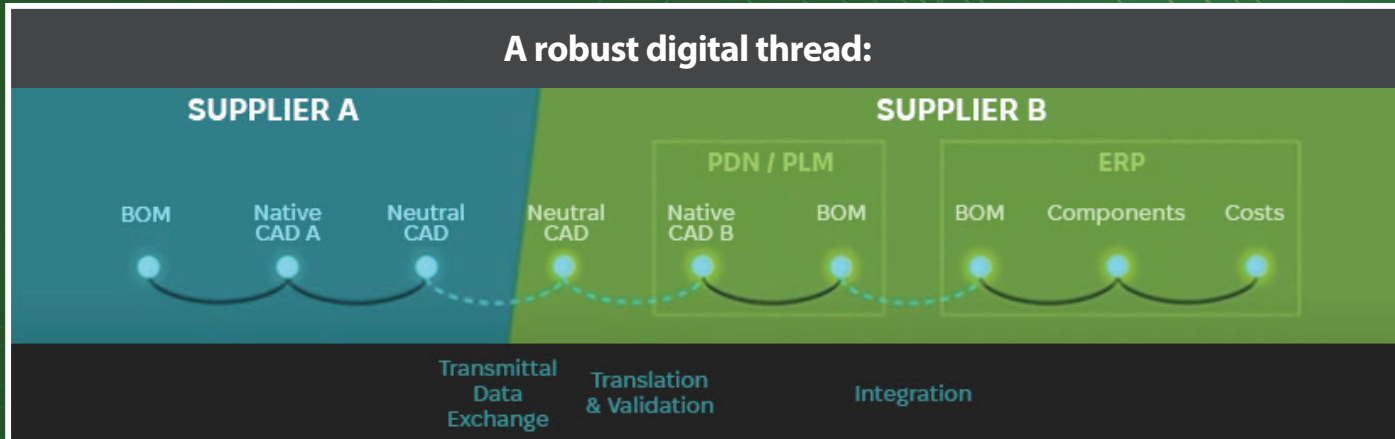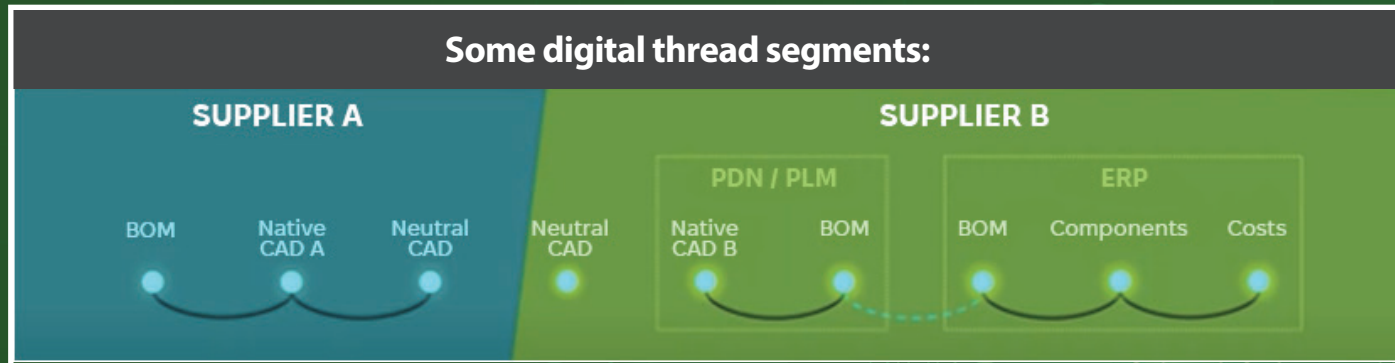
# Organizational Change Management (OCM)

"The changes we're describing are really, really significant," says Razorleaf's Scott. MBE necessitates operational changes internally, between teams, as well as externally, with other entities or partners. This means process or even contractual changes to how you handle and communicate data. It also may mean multiple different new processes because a change from handling documents to handling models isn't a one-to-one, it's one-to-many. Models in particular are specialized and may require different operating procedures for different kinds of models. In addition, the dynamic nature of models means interacting with and sharing them in non-standard ways.

**With Model Based Enterprise we're changing:**

- How large parts of the internal organization operate

- How the organization works with partners and suppliers

**Models are different:**

- Models are specialized, complex, digital things

- Models can't be handled like electronic documents

**Models are dynamic:**

- Models don't fit the sequential paradigm of many business processes

- Models are constantly evolving, like code

# OCM: How to Be Successful

Successfully making an organizational change requires making sure everyone in the company understands the value of a model-based approach - even those with no experience working with models. Until people know why they're working with models and see the benefit, "you really can't expect people to work with something they don't understand and haven't been given the right tools for," Scott says. He offers five must-haves to reach success:

**1**  **Alignment:** Everyone in the organization must understand what the target and goals are - and how to get there together.

**2**  **Communication:** Everyone, from the top down through all levels of the organization, needs to know that every other part of the organization is on the same page.

**3**  **Education:** People must understand the what and the why of the goals the organization is trying to achieve.

**4**  **Training:** Workers need skills development so they understand how to use new tools, how to work through new processes, and more.

**5**  **Ongoing support:** Because change is difficult, people will need technical support, management support, and even emotional support to make the transitions.

**Alignment**          **Communication**          **Education**
(on concepts)          **Training**
(on tools & processes)          **Ongoing Support**

# Keys To Success

| SUCCESS | vision | + | organization | + | process | + | provider(s) | + | approach | + | environment |

## CIMdata keys to success:

**1** Develop your vision for your version of a model-based enterprise, and keep a broad perspective. Don't focus too narrowly on the details.

**2** Stay aligned with company culture and get the right people involved. This ranges from training and buy-in with senior management to selecting the right partner to support your goals.

**3** Understand your scope and don't let it get out of control. Define your scope well and bite off small chunks of work with well-scoped pilot projects.

## Razorleaf keys to success:

**1** The three foundational capabilities that will help you make your digital transformation to a model-based enterprise are maturing the digital thread, data exchange and integration, and organizational change management.

**2** If you build these capabilities within your organization, with your partners, and with your ecosystem - which includes integration partners and other support for the journey - they will help you drive toward MBE.

To view the on demand discussion, Setting a Foundation for Model-Based Enterprise, with Derek Neiding, Jonathan Scott, and Peter Bilello, go to: **https://www.razorleaf.com/setting_a_foundation_for_mbe_webinar/**

**For more information and an evaluation of how Razorleaf can help you achieve your digital transformation goals, contact us.**

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### About Razorleaf

Razorleaf is a consulting & systems integrator specializing in product lifecycle management (PLM) to help the world's most innovative manufacturing organizations bring new products to market. We partner with our clients to connect products and processes across the digital enterprise to drive more value. Led by a highly skilled and seasoned team of experts across the United States, Europe, and India, Razorleaf offers comprehensive consulting, professional services, and proprietary software products focused on gaining business efficiencies around PLM, Design Automation, Integration, Test Automation and Model-Based strategies.