Make the Data:
A Data-Centric Vision for the Nation of Makers Community.

Diversity is our force, Unity our power.

2022

Prepared for Flight
THE IDEA DEVELOPMENT COMPANY

NATION OF MAKERS

MAKE THE DATA

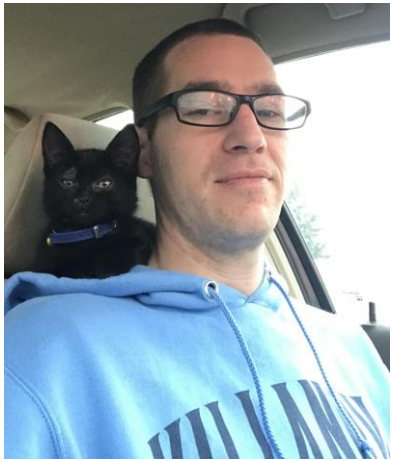
Summary Statement

Nation of Makers® engaged the international Makerspace community with a new 2021 survey. Prepared for Flight® performed data analytics for Nation of Maker's Data Working Group.

The presentation discusses the data-centric vision for "*Makerspace as a supply chain"*, present and near-term needs for real time community engagement, and the lessons learned from the past two years of data collection.

The *2021 Data Working Group* developed a new survey framework with real time data analytics and dynamic visualizations to enhance *Nation of Maker's 2021 Members Survey Report*.

Presenter Bio: Zackary Scalyer



Zackary Scalyer is a lead developer at Prepared for Flight and a mathematical statistician for the Demographic Statistical Methods Division at the US Census Bureau. He is an educator at heart, an advocate of the open-source community, and mentor in STEAM education.

Zack's projects have included developing artificial intelligence workflows for recommendation engines, classifiers, and pose detection.

He is team lead of the software architecture group for Prepared's upcoming LockBox Secure PC product.

Presenter Bio: Ed Wyrwas

Ed Wyrwas is a serial entrepreneur and inventor working full time for NASA GSFC in EEEE parts assurance and radiation effects, leads the executive team at Prepared for Flight, and provides STEAM mentoring to several academic programs.

Ed is on both NASA and ASME's working groups for additive manufacturing of non-metallic polymers and is a sponsoring founding member of Nation of Makers. Prepared for Flight is a product design studio and conducts in-house FFF polymer material research and development. Prepared's domestic *Manufacturing Collective* includes many independent makers, several makerspaces, 3D printing filament manufacturers such as Kupros, Inc, and academic institutions.

Ed champions projects requiring his knowledge and expertise in electrical and computer engineering, electronics reliability and failure analyses, cybersecurity, full stack software development including firmware, and rapid prototyping.

Agenda

→ Data → Makers → Makerspace → Nation of Makers → Data Working Group

→ Lessons Learned During A Crisis

→ Obstacles → Empowering Individuals → Ideating a Solution

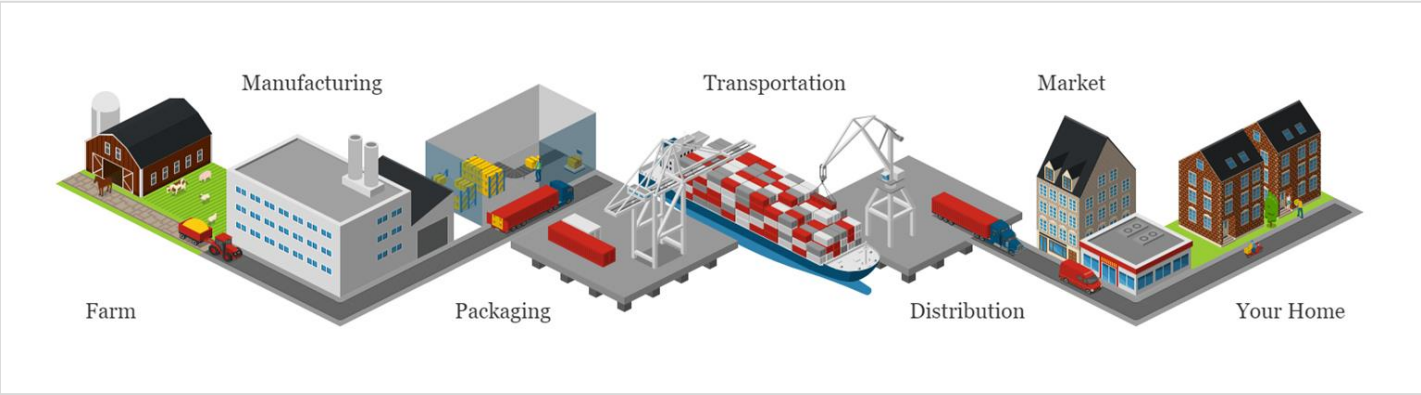
→ What Can We Do With Data?

→ Current and Future NOM Survey

→ Call to Action, What can we do.

→ Observations & Conclusions

Everyone collects data.



Big Data is a common term nowadays, but it is not common practice yet.

We collect data throughout the lifecycle of many of the products we consume.

Data is collected on our farms to evaluate crop health, to track manufacturing steps and integrity of raw materials, to track expiration dates of packaged goods, to track global shipments, to trade stocks, to place bets, to recommend online media, …

Data is everywhere, being evaluated behind the scenes and leveraged in real time to improve the consumer experience.

Individuals and Makerspaces

People are the most critical resource in all supply chains.

Every organization has latent potential to improve business continuity and successful operations by leveraging people and quantifying their capabilities (aka making the data). Technical prowess, the ability to quantify capabilities (e.g., personnel, equipment, processes, supplier relationships), is a major blocker to this largely untapped resource for most makerspaces.

People are the necessity to create *thought leadership*. Through collaboration, employee diversity, and workplace policy, knowledge can be shared throughout an organization to develop a reputation as industry leaders.

Data Opportunity ~ Data Threat

Many considerations such as accessibility, costs of activity, and experience allow makerspace organizations to effectively make decisions which lead to long term successes.

Comprehension of data requires a complete synchronous picture of the makerspace operations which inform how data is to be used effectively.

Emphasizing one variable without understanding the others can compromise the business operations and performance of the makerspace, leading to issues with member retention, inventory, and funding.

Data Working Group

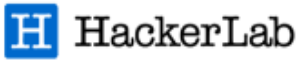
A makerspace or hackerspace can be a complicated beast to run. They are places for the community to gather, where you can learn, tinker and socialize. You can hone your hobbies or develop your small business. Different makerspaces are set up for folks of different age groups.

The mission of the Data Working Group is to support these spaces, and to provide the maker community data as a regular stream of information that will help spread the word about the impact and importance of these facilities.

Makethedata.org is run by the data working subcommittee of the Nation of Makers. We conduct the annual Survey of Makerspaces, and other survey/research initiatives focused on making.

As a central convener of the maker community, Nation of Makers maintains a unique overarching view of the impact of the maker movement on a wide range of sectors and fields; from education to defense, manufacturing, economic development, entrepreneurship, and more.



Nation of Makers

Leaderboard

Survey of Makerspaces - 2021 Report Out

2019 Survey of Makerspaces Report

Report Team: The Nation of Makers Metric of Impact Working Group, 2019 Edition

Survey Authoring:
Paul Bierkolo
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Liam O'Brien

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Jeanette Breton
Katherine Cannistra
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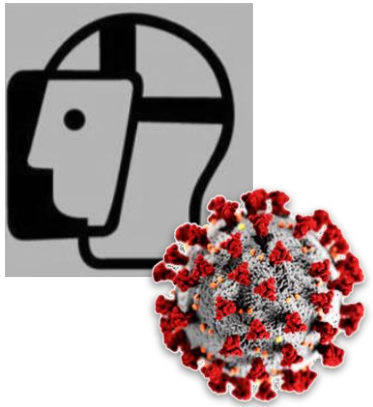
Bradley O'Matthews
Ronald Williams

Thank-you to Open Works for supporting the 2019 Data Retreat (where the survey was authored) and to all of the makerspaces and individuals who have helped promote this effort.

Nation of Makers 2018 Survey

Demographic Overview, Members & Leaders Survey

A Call to Action



COVID-19 overloaded supply chains and exhausted reserves of Personal Protection Equipment (PPE). The nation was left with little options as it attempted to mobilize production and create international supply routes. It became apparent that difficulties arise with limited domestic capability.

A synergy was felt between independent Makers and makerspace organizations across the nation who wanted to provide assistance using their own time, equipment, resources, and expertise. Makers united under the guidance of Nation of Makers and other organizations like Open Source Medical Supplies, Helpful Engineering, and Get Us PPE, mended the supply chain gap.

Makers became the short term solution to the nation's crisis.

Get Us PPE

OSMS
Open Source Medical Supplies

Coming together, a diverse group of worldwide makers was able to provide a rapid response force creating over 48M pieces of PPE during the pandemic.

Prepared for Flight engaged with Nation of Makers and its members to coordinate production of PPE during the COVD-19 pandemic. Prepared's team members produced over 1,000 items for individuals and organizations from VA to NY.

Data regarding Volunteer Participants was key to reducing response time when requests were made.

- Knowing who had local manufacturing equipment
- Knowing where the equipment was located
- Knowing who had time and resources to volunteer
- Knowing who needed what PPE

Novel tools and supplies invented on public open source forums, including mask pleating jigs (left), bias tape folders (right). Source: OSMS Project Library

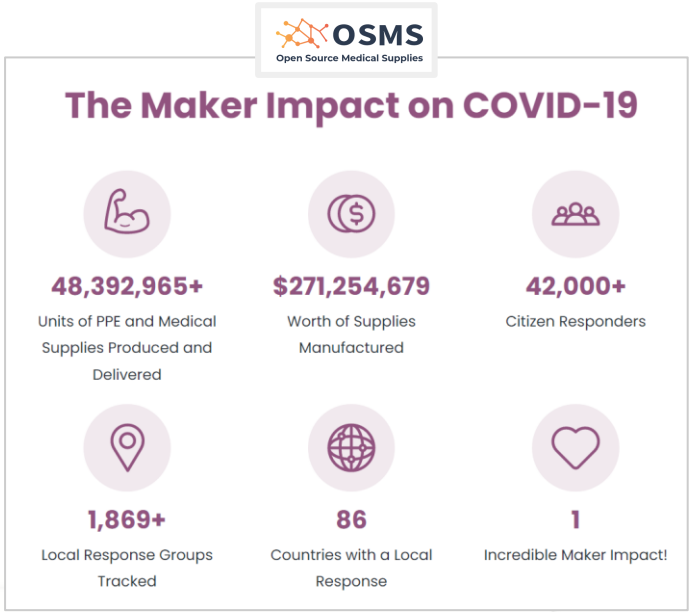
https://opensourcemedicalsupplies.org/wp-content/uploads/2021/01/Design-Make-Protect_21.01.27.pdf

Collecting Data

Agility happens through collaboration by having good data

Data collection leads to operational awareness, resource accountability, and improved marketing strategies.

Data creates a feedback loop to iterate and improve.



Question: Did you pay a membership fee at your primary makerspace in 2021?

Response Value	TOTAL	Female	Male	Non-Binary	Unknown
Yes - Monthly	52	14	36	1	1
Yes - Annually	10	0	9	0	1
No - my makerspace doesn't charge membership	5	2	3	0	0
No - have a granted membership	4	2	2	0	0
No - I volunteer/trade work for membership	4	1	3	0	0
Yes - Occasionally (based on projects or other factors)	4	1	3	0	0

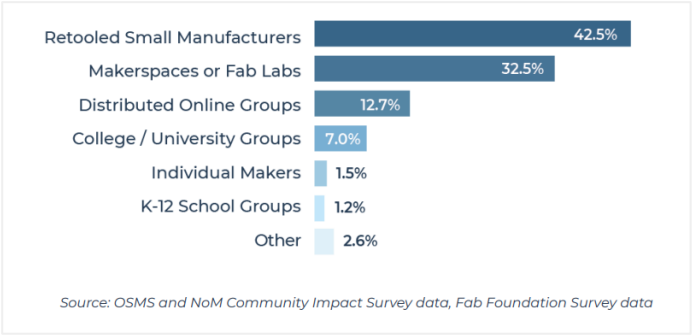
Deafenbaugh, J. L., Scayler, Z. & the Nation of Makers Metrics of Impact Working Group (2022). 2021 Nation of Makers Annual Survey of Makerspaces Report. Nation of Makers. makethedata.org

Digging Deeper into the Dataset

Figure 7: Manufacturing equipment utilized By the U.S. Citizen Maker Response

Manufacturing Process	% of U.S. Respondents Using Process
3D Printing	67.5%
Sewing	56.6%
Laser Cutting	39.6%
Die Cutting	11.2%
Vacuum Molding	9.8%
Injection Molding	6.9%
Die Casting	1.8%

Source: OSMS and NoM Community Impact Survey data



Source: OSMS and NoM Community Impact Survey data, Fab Foundation Survey data

To the extent that makerspaces serve as community centers for entrepreneurship, education, and workforce development, they often also have regional connections to other makerspaces, social service and non-profit organizations, and government officials. During the COVID-19 pandemic, **makerspaces forged new and necessary partnerships with local healthcare institutions and began serving as both improvised production facilities for medical supplies and design/prototyping facilities to create new products and improve on existing designs.**

Distributed Manufacturing Networks

In addition to individual makers, makerspaces and small manufacturers, a new approach to manufacturing provided a significant number of supplies throughout the pandemic. Distributed manufacturing networks, organized online and often consisting of collaborative networks of companies, makerspaces, schools and/or individuals that owned fabrication equipment, sprang up across the world to provide a significant volume of PPE to their regions based on shared open-source design files.

This work was done in collaboration with Open Source Medical Supplies

Example of Establishing Supply Chains

74% of the participants in a 2020 Gartner Smart Manufacturing Strategy and Implementation Trends Survey report having a smart factory initiative at their organization

National Case Studies

OSMS
Open Source Medical Supplies

MAKER'S ASYLUM

The M19 Initiative came together with a **centralised open source design philosophy with decentralised manufacturing so that we can gather the best minds to solve the pressing challenges** of this country **and execute with agility.** The importance of locally making for local environments has never been more important and that convergence with the maker movement makes a very strong case of digital manufacturing! Solving problems requires a multidisciplinary approach and that's what makes the M19 Collective special. Collective open innovation and social entrepreneurship is the core tenet of the initiative! (Based in India with international support)

Supply Chain Robustness

A resilient supply chain is one that recovers quickly from an unexpected event.

Data helps to identify pressure points that could cause economic pain domestically if left unchecked.

The reliance on long supply chains has made the country vulnerable to hiccups in deliveries of goods.


What End of the Chip Shortage? Carmakers Remove More Systems, Stop Production

Home > News > Technology

23 Jun 2022, 21:20 UTC · by Bogdan Popa


RETAIL • SHORTAGES

'End of days': Stressed supply chains mean summer shortages of shopper favorites like beer, popcorn, sriracha

BY SING YEE ONG AND BLOOMBERG

June 19, 2022 10:32 AM EDT


INNOVATION

Baby Formula Shortage Underscores Need For Supply Chain Resilience

Richard Howells Brand Contributor

SAP BRANDVOICE | Paid Program

May 19, 2022, 07:30am EDT


REVIEWED

Supply chain issues have caused a tampon shortage: where to buy them —and alternative options

Isabelle Kagan

Reviewed

Published 4:24 p.m. ET June 23, 2022 | Updated 4:57 p.m. ET June 23, 2022


BREAKING • BUSINESS

Biden Administration Importing 23 Million Bottles Of Baby Formula Into U.S. in Biggest Step Yet To Combat Nationwide Shortage

Brian Bushard Forbes Staff

I cover breaking news for Forbes

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Jun 22, 2022, 12:33pm EDT

Supply Chain Robustness

Data permits proper gap analysis which is motivation to double down on keeping key manufacturing at home or in countries aligned with U.S. values and interests


KENTUCKY · Published June 24, 2022 1:05pm EDT

Kentucky aluminum plant cuts off production, lays off 600 workers due to high energy costs

KY aluminum plant must halt production as energy costs rise


Product shortages reveal fragility of U.S. supply chain

Grocery shoppers have likely noticed an empty shelf of late where household staples like baby formula or sunflower oil are normally on display. Many online buyers are also coming up empty on everything from packaged goods to clothes and tools. About 31% of grocery...

APR 13, 2022

Where the pandemic didn't make that clear to us, the war in Ukraine will.
The pandemic revealed the U.S. wasn't prepared for major shocks to its supply chains.
This vulnerability stretches across whole sectors of the economy.

Pain is typically the requirement to jump start a more localized supply chain. Individuals quickly adapt to these situations. Working together they ensure we can meet the needs of our society when urgency is highest.


Copper dips below $4 per pound, suggesting the global economy is in trouble

The metal's bull run is losing momentum, a troubling sign for economic growth

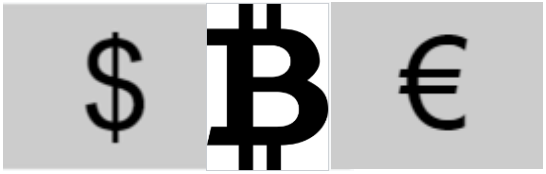
Gabriel Friedman
Jun 23, 2022 • 1 day ago • 4 minute read • Join the conversation


School lunch programs feel pinch of rising food prices, shortages and supply chain issues

Nationwide, school lunch programs are grappling with the rising food prices and ingredient shortages due to supply chain disruptions. CBS News correspondent Scott MacFarlane spoke to school lunch administrators who are struggling to put together the weekly lunch...

MAY 23, 2022

Economic Perspective

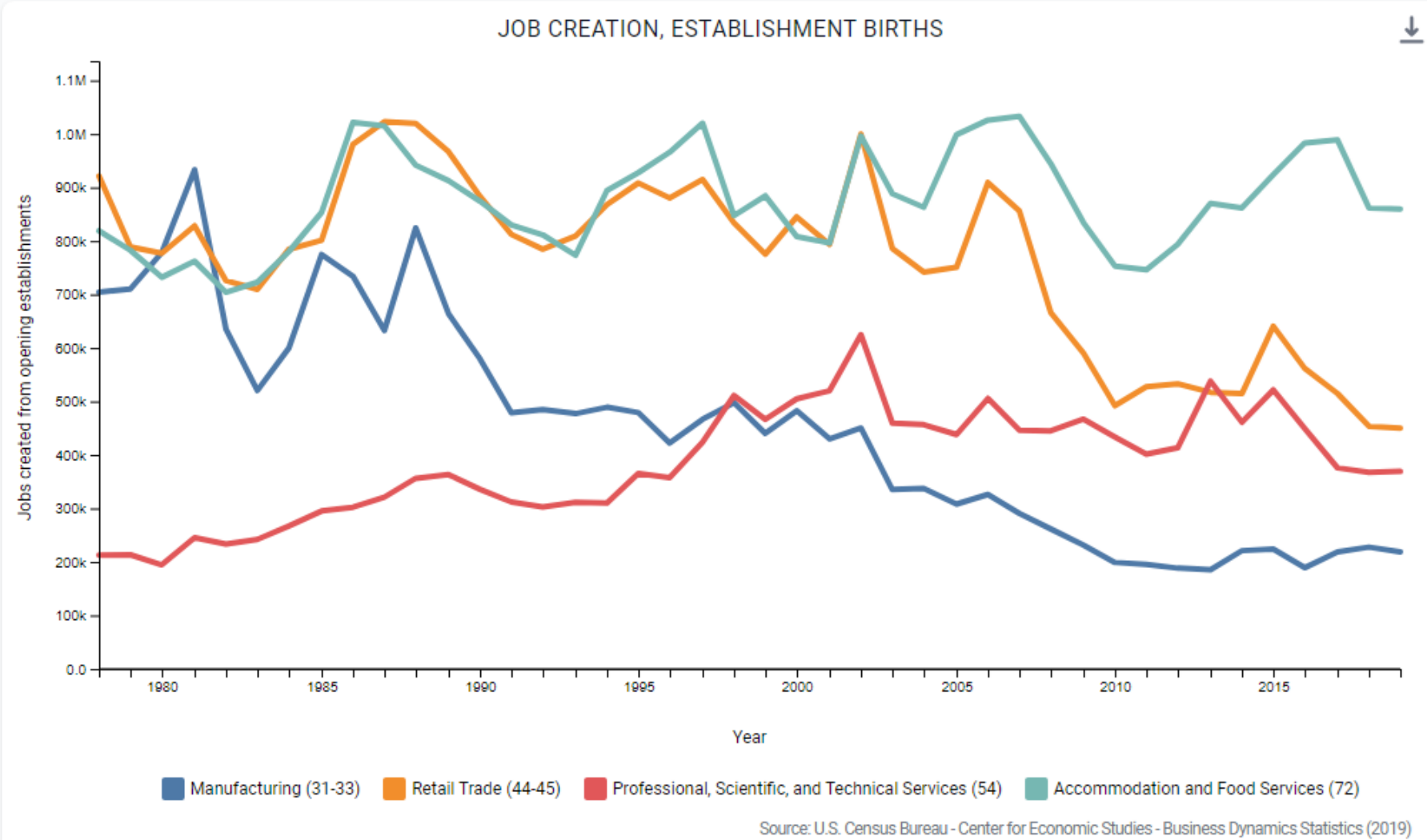


From an economic perspective, supporting a robust manufacturing base is unbelievably important. Countries which have experienced impressive economic growth over the past 100 years, was due to the development of a strong domestic manufacturing industry.

Over the past 40 years, manufacturing has been sent to wherever production is the cheapest. That has always been a losing proposition. Once a country's economy improves, manufacturing becomes less competitive and then moves to another low-cost region. In many markets, cost-savings rarely is passed to the consumer of the goods. When profits decrease, manufacturing tends to move elsewhere.

Since the turn of the decade, sourcing and manufacturing have come under renewed focus, as has the push to reshore and improve domestic manufacturing. Quality, legality (i.e., hazardous substances), and increasing lead times have contributed toward this paradigm shift.

Unfortunately, **permanent infrastructure and an established workforce are long term developments and expensive commitments.**


JOB CREATION, ESTABLISHMENT BIRTHS
Jobs created from opening establishments
1.1M
1.0M
900k
800k
700k
600k
500k
400k
300k
200k
100k
0.0
1980
1985
1990
1995
2000
2005
2010
2015
Year
Manufacturing (31-33)
Retail Trade (44-45)
Professional, Scientific, and Technical Services (54)
Accommodation and Food Services (72)
Source: U.S. Census Bureau - Center for Economic Studies - Business Dynamics Statistics (2019)

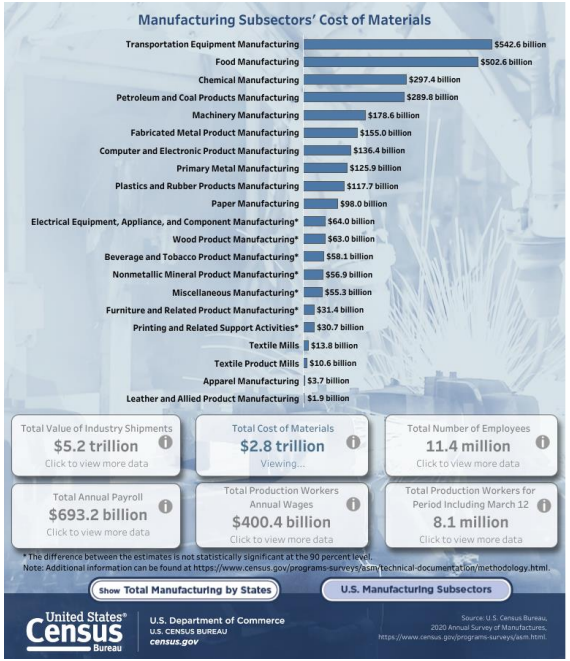
White House / Census Bureau Findings

https://www.whitehouse.gov/cea/written-materials/2021/06/17/why-the-pandemic-has-disrupted-supply-chains/

Figure 2. Supply-Chain Disruptions By Sector

In the last week, did this business have domestic supplier delays? (percentage saying yes)

Sources: U.S. Census Bureau; CEA Calculations.



Advocating for Everyone.

Makers are developing new solutions and products for pressing challenges, engaging students in hands on, interactive learning of STEM, arts, and design, and enabling individuals to learn new skills in fabrication and manufacturing.

NoM's mission predates, but is aligned with Biden's 100-day plan:

> "**We must ensure that economic opportunities are available in all parts of the country and for women, people of color, and others who are too often left behind**. Inequality in income, race, and geography is keeping millions of potential workers, researchers, and entrepreneurs from contributing fully to growth and innovation. Today, children with the talents to become inventors, are less likely to become patent holders if they are low-income, women, African American, Latino, or from disadvantaged regions. **The Administration's approach must provide access and pathways for these "lost Einsteins"** — workers, researchers, and businesses-owners in the growing industries of the 21st century."

Biden 100-day Report (Reference)

American workers must be the foundation for resilience. **Resilient production requires quick problem-solving, driven by the knowledge, leadership, and full engagement of people on the factory floor**. Decades of focusing on labor as a cost to be controlled —not an asset to be invested in —have depressed real wages and driven down union-density for workers, while also contributing to companies' challenges in finding and keeping skilled talent. We must focus on creating pathways for all Americans to access well paid jobs with the free and fair choice to organize and bargain collectively.

https://int.nyt.com/data/documenttools/2021-biden-100-day-supply-chain-review-report/e899e30cb19c764b/full.pdf

Obstacles

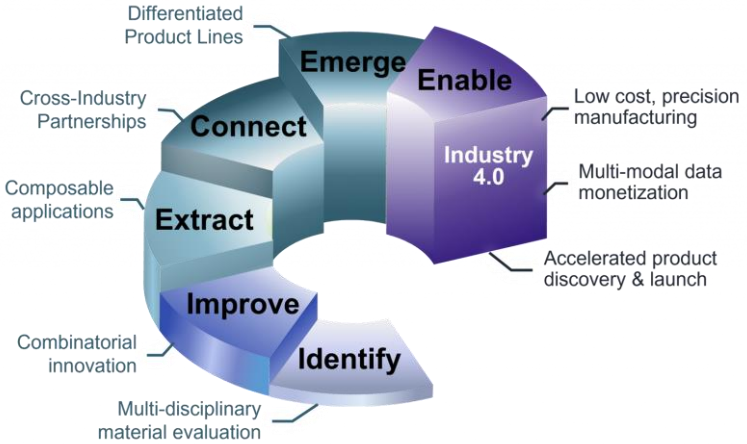
To move successfully to domestic supply chains, U.S. manufacturers face three major obstacles: (1) cost, (2) skills gap, and (3) infrastructure

- Cost is largely attributed to acquisition of raw materials and inability to reuse or repurpose non-conforming products. (i.e., recycling)
- The skills gap trend also can be attributed to a systematic problem: many U.S. educational institutions have failed to emphasize opportunities in manufacturing, and the perception that manufacturing is a dead-end field often exists. To remedy this situation, Nation of Makers members introduce and support science, technology, engineering and mathematics (STEM) programs.
- Shifting Away From Centralized Supply Chains; Focus on point of need and responsiveness; Over the last 50 years, the United States has shifted from a manufacturing economy to a service economy, and its infrastructure has been largely neglected.

US Census Bureau data shows a steady downward trend of new manufacturing jobs and domestic retail trade.

Industry 4.0 - Agility Overcomes Obstacles

Data will drive the next industrial revolution.

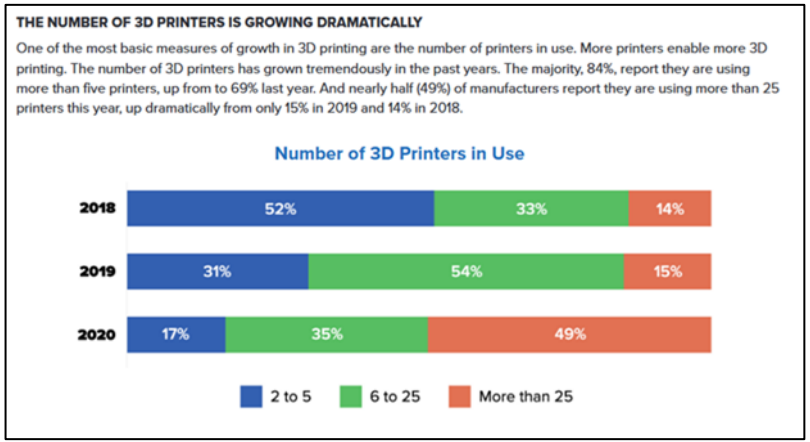


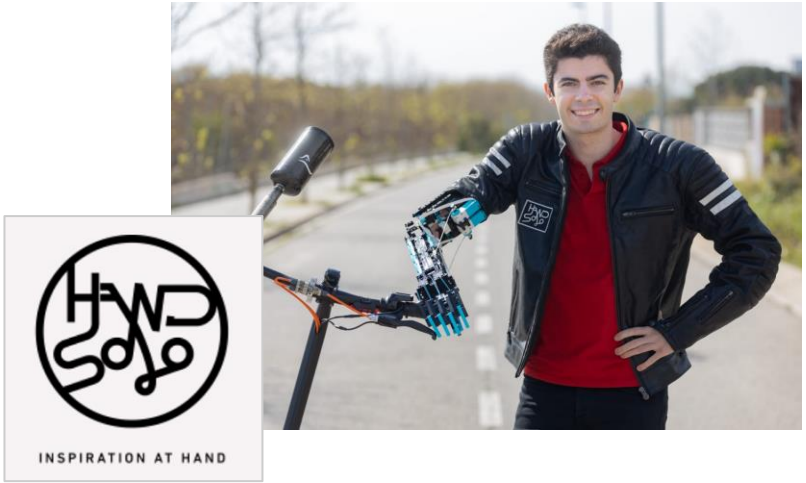
Access to equipment and the ability to “DIY” equipment will lead to quicker adoption.

Empowering Individuals

This decade has seen a growing number of Americans gaining access to technologies such as 3D printers, laser cutters, easy-to-use design software, and desktop machine tools.

Getting technology into the hands of more people in combination with freely available information about how to use, modify, and build upon these technologies is enabling more *people* to design and build almost anything.





https://handsolo.com/

https://f.hubspotusercontent20.net/hubfs/5442420/Trends_in_3D_Printing_at_Scale_Essentium_2020.pdf

Ideating a Solution

Nation of Makers and Prepared for Flight created a data analytics framework to:

- Perform real time analytics
- Leverage quantitative data which is actionable
- Measure responsiveness and readiness

Implications:

- Identifying the needs and capabilities to help our community help themselves.
- Identifying opportunities outside of the community with data driven impact shared

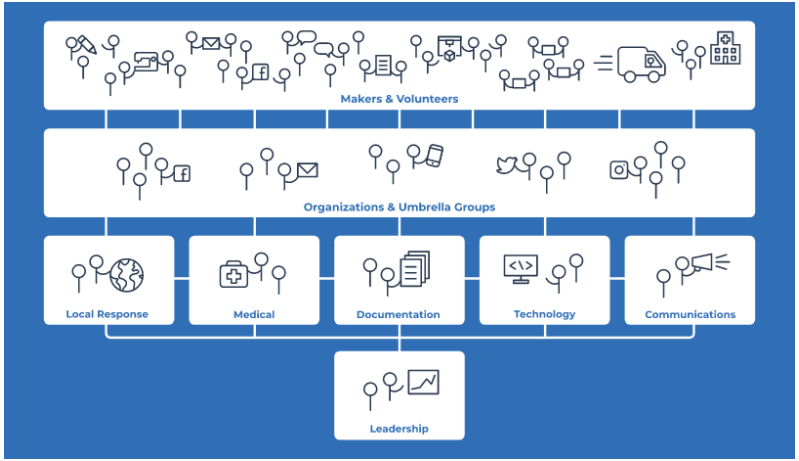
Identifying personnel:

- Crazy folks interested in data analytics, data visualizations, market trends, etc.

What Can We Do With Data?

Data permits

- Agile processes
- Ability to assess the impact of the movement on education, economic and workforce development, entrepreneurship and the development of innovative communities
- Sharing of experiences and resources to build a stronger community
- Encouragement and awareness beyond the community
- The community to monitor our shared impact



https://p4flight.com/covid-19

Great Data Permits Rapid Responses

Sometimes shortages of a small, unassuming component can keep a company from finishing a product and getting it out the door. Emphasizing this point, a small relatively inexpensive, easy to produce component may be the difference between life and death.

The Washington D.C. Fire and EMS department had an urgent need for adapters to add additional filters to their CPAP machines. The department had filters on hand and packaged, but required an adapter to make it work. The adapters were sold out everywhere and usually cost $2.17 each.

The need was acute and ongoing - these are disposable kits used to assist folks on the way to the hospital. Initial quantity desired was 1,000 units.

- NOVA Labs in Virginia worked with Nation of Makers to identify regional makerspaces with suitable equipment and expertise to produce these components.
- Prepared for Flight was contacted on Friday. We were up and running by Saturday morning and 3D Printing approximately 4 adapters per hour.
- The maker community in the region produced the entire 1,000 unit order before Monday morning.

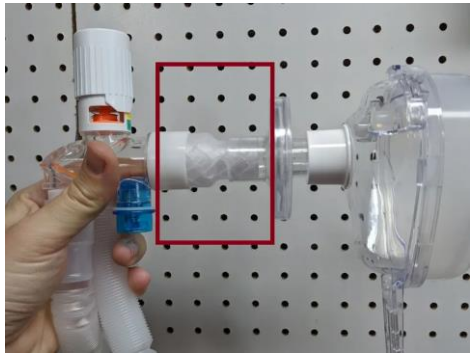


Image credit: Paul Chase (NOVA Labs)

Open Source Medical Supplies (OSMS)

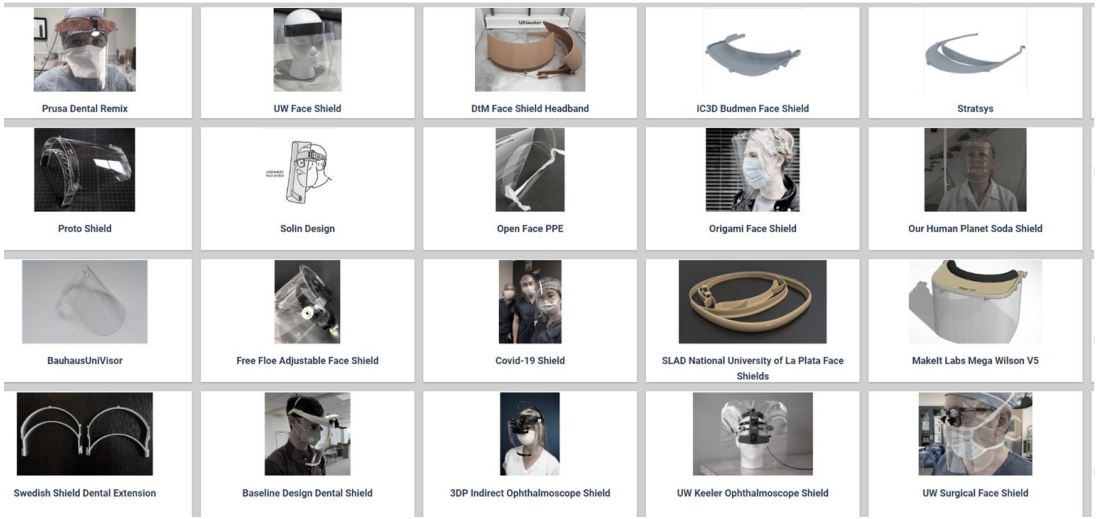
In lieu of the slow responding governance, a crowd sourced collective formed Open Source Medical Supplies Community Facebook group that consolidated information to produce a resource document that filled a regulatory gap.

What started as a single resource document has grown into an encompassing repository of manufacturable medical supplies.

Open Source Medical Supplies (OSMS)

*"The **first version of the guide was published on March 18, only 8 days after the start of the forum** and **3.5 weeks before the FDA released any EUAs or guidance** for non-traditional manufacturers.*

Three weeks after its formation, OSMS began actively organizing "Local Response Groups" to help makers meet demand in their communities and regions. Within one month, it had accumulated a global network of over 70,000 makers, fabricators, community organizers, and medical professionals working to meet the medical supply challenges stemming from the COVID-19 pandemic."



Data-based Decision Making

How can a small Makerspace overcome the blockers of big data?

Examples include: analytical insight into staff capabilities, cost of collection, insufficient digital resources, …

Through community collaborations and initiatives spawned during a time of crisis, we *now* have the formula to collect, leverage, and benefit from big data. We can consolidate individuals efforts and insights to inform our specific business choices.

Sourcing	Production	Warehousing	Transportation	Point-of-sale	Consumer
• Cost modeling to identify cost drivers • Quantification of benefits from spend pooling • Automatic analysis of contract compliance • Aggregate demand/supply balancing	• Scheduling of energy-intensive production • Statistical quality control and tolerance optimization capabilities • Lot sizing and scheduling considering cost, inventories, and capacities	• Picking zone/ warehouse space allocation • Worker to picking zone allocation based on efficiency • Automatic stock relocation in high bay storage areas • Cleansheet cost modeling • Workload optimization	• Real-time routing and ramp allocation at warehouses • Delivery scheduling in line with consumer patterns • Cleansheet cost modeling • Dynamic routing	• Out-of-stock detection and prevention • Shelf space optimization • Channel/store allocation of goods maximizing service • Retail employee scheduling	• Credit rating to define payment terms offered • Return projection to calculate outstanding inventory • Product recommendations based on purchase history • Fraud detection

McKinsey&Company | Source: KLU research report "Supply Chain Analytics—Gaining value from data-based decision making"

Data-based Decision Making

Many large corporations have shown the power of leveraging big data:

- forecasting inventory and sales,
- reducing uncertainty of solicited bids,
- early defect detection,
- optimised distribution, …

Big data frameworks can be leveraged at the smallest of makerspaces.

“data from all of us” is “data for all of us” and it empowers leaders and members of the maker community to make informed decisions using shared resources from across this community of practitioners

Making a Plan

https://www.makereventplaybook.org/

The Maker Event Playbook is a community-driven playbook that documents a wide range of maker events and the topics that are relevant to maker event organizer. Whether you host small workshops in a makerspace or produce a large multi-day maker event such as a Maker Faire, this playbook is a place for you to find helpful information and to share the what you've learned with others.

The Maker Event Playbook is a project of Nation of Makers, and will be maintained long-term by the Nation of Makers community. The project's initiation can be traced back to the maker event organizer track at NOMCON 2019 (the Nation of Makers annual conference) with a workshop that led to a call to action for a community-driven playbook for maker events. With support from Google as part of their ongoing support for the maker community, a project team formed in the fall of 2019 and the playbook was launched at NOMCON 2020!

Data Creates a Better Makerspace Experience

Makerspaces leaders are already tracking inventory and equipment in NoM's slack and its facebook group.

Makerspaces offer classes and need to track materials/consumables and equipment. Additionally they can do sentiment analysis from course feedback, and also better projections for curriculum using data they have on hand.

Examples of supply chain analytics include:

- demand planning (using historical data and other factors to predict what customers will order);
- sales and operations planning (manufacturing and/or purchasing the goods an organization needs to cover forecasted demand);
- inventory management (tracking sell-through of items and which SKUs it needs to replenish).

Each of these activities can increase the overall efficiency of makerspace business operations, which can lead to sizable cost savings. For instance, more accurate demand planning means you avoid overspending on procurement while also avoiding both backordering and excess inventory (which can turn into obsolete inventory).

An entire community of help:

Hello, I'm currently looking for recommendations for makerspace software that can scan in members, track In and Out times and monthly member payments, handle equipment checkout times, possibly tool tracking system, has some kind of calendar for scheduling, and room rental reservations. Does anyone have a software that does some or all of this? How do you streamline and manage these functions at your makerspace?

I'm working on a makerspace with the city Parks and Recreation D... **See more**

5 39 Comments

Is anyone starting Pi Day planning? What are you hoping to do this year?

What is the most durable, efficient, compact, and affordable machine/set up you have used to make custom adhesive-stencils?

12 Comments

Does anyone have any experience with setting up indoor spray booths without exterior ventilation? Our building doesn't allow us to vent outside, so any air filtration we need to do would be part of a self-contained unit. Does anyone have experience with using spray tents with HEPA filters or something similar?

8 Comments

Hello! I am a 10-12 high school math teacher (previously spent 15 years as a foundry engineer). This next school year, I'm going to be teaching an elective class, "Applications of Engineering and Technology". I'm researching for this course, I've discovered these cool Makerspaces! So, I want to build one for my school. It will start as a table and storage in a corner of my classroom, but hopefully grow in the next few years.

My question is what equipment and supplies ... **See more**

You and 7 others 17 Comments

Okay maker hive! We are in dire need of a website redesign and want to know if anyone has recommendations of designers familiar with the makerspace concept or favorite sites we should look at as case studies.

5 11 Comments

Anyone have recommendations for metal cutting lasers? High end university makerspace needs some shiny. I'm imaging something larger and more capable than a fablight, but not a two-room 5'x10' industrial monster. Interested in brand and model recommendations, and your experiences operating them (including if you think they're terrible for makerspaces)

2 18 Comments

We're looking to "step up our game" in the area of sewing, with a better setup than what we have. Currently it's a desk in a high traffic area, but we have allocated a well lit area with more space. For those of you that have spaces that support a lot of sewing makers, can you share qualities of that area that seem to work best? I've googled lots of sites and have a decent idea of what we need, but I'm curious what the experts in this group may suggest.
In particular, most... **See more**

5 17 Comments

Does any know any standard open source Maker/Hacker/Fablab curriculum in place for k-12 schools and colleges/trade schools?
What standards are in place for each discipline?
#askingforamaker

“Not Asking is the Only Non-Starter”

Value Proposition

Process real time supply chain data to determine in-house capabilities and 3rd party support.

- Realize when it’s time to shift objectives
- Be decisive after assessing data - a lack of resources should be a significant driver to find a trusted partner
- Be proactive rather than reactionary

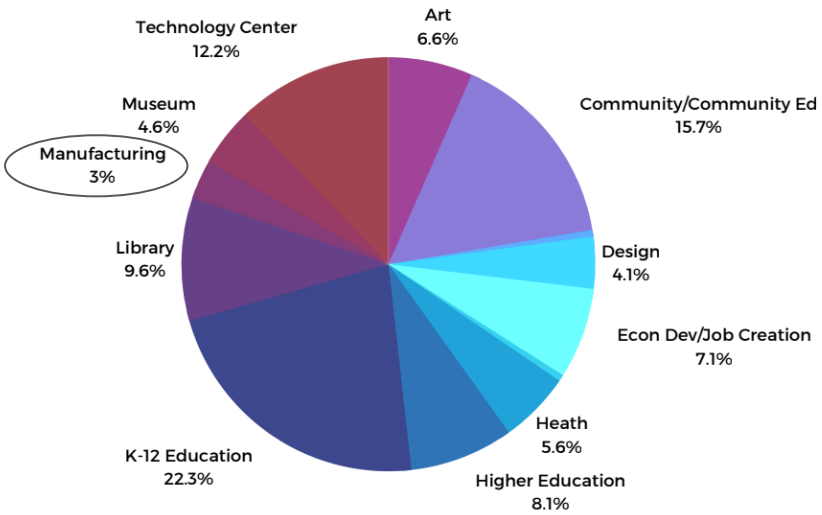
Omnichannel Fulfillment should start with Distributed Manufacturing

- “Strategy where businesses use multiple selling channels to fulfill and distribute customer orders, regardless of which channel the customer placed an order through”
- Streamlining processes from manufacturing through delivery by integrating each element into an interconnected network
- The application of omnichannel in manufacturing primarily focuses on the collaboration between suppliers, or vendors, and distributors.

An organized collective of **makerspace champions can provide omnichannel strategy** and act as a 3rd party logistics (3PL) provider **for rapid response at point of need**.

Last Year's Data

Sectors represented by maker leaders in attendance at NOMCON 2021

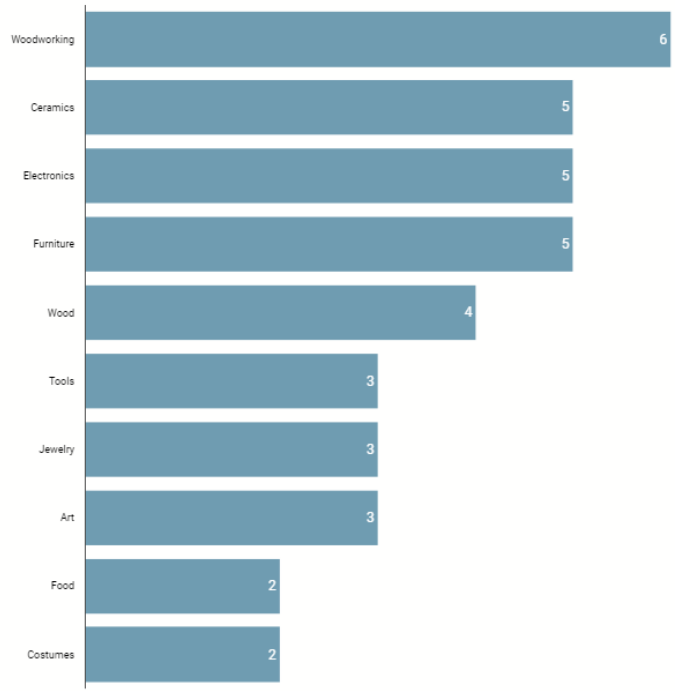


2021 Member Survey

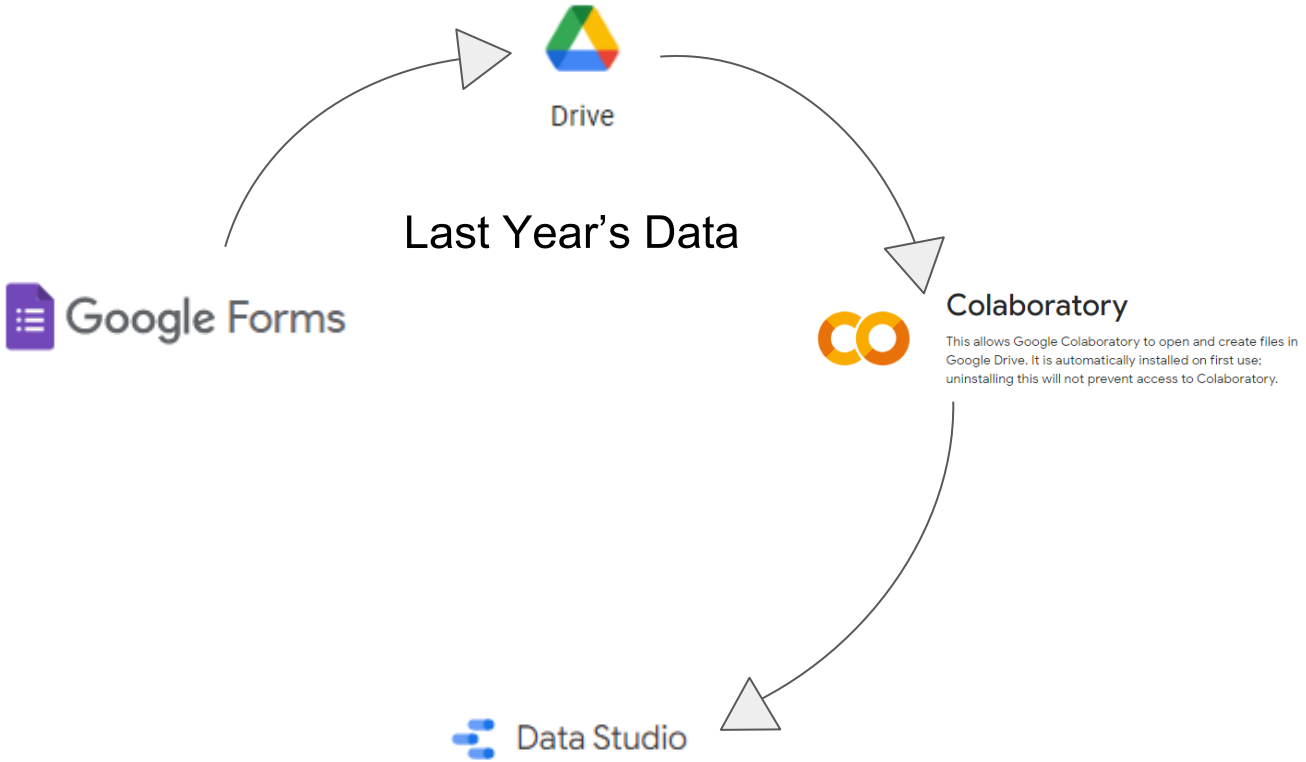
Nation of Makers Survey of Makerspaces

Here are the totals for all responses for the Survey of Makerspaces.
This data set includes all makerspaces of all types.
To see a breakdown by different demographics, go to sections 3, 4, and 5

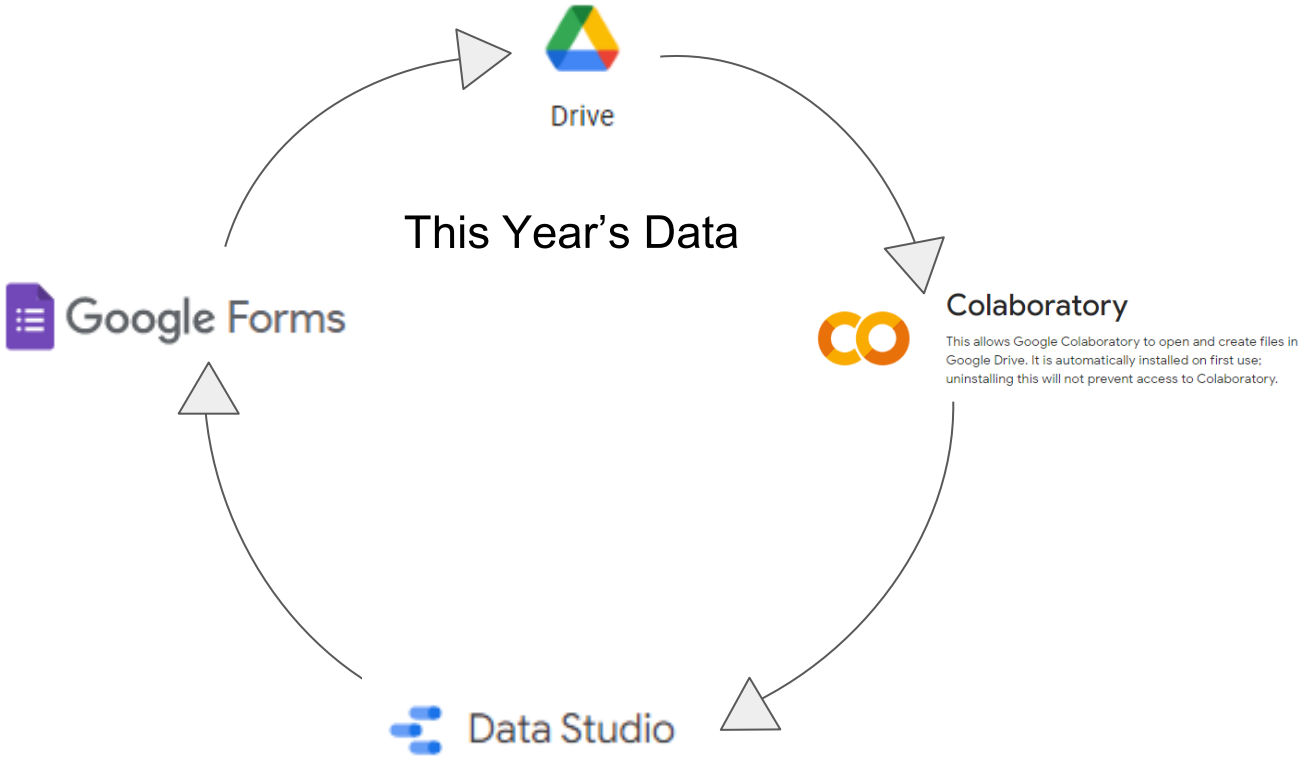
Question: What do you make?



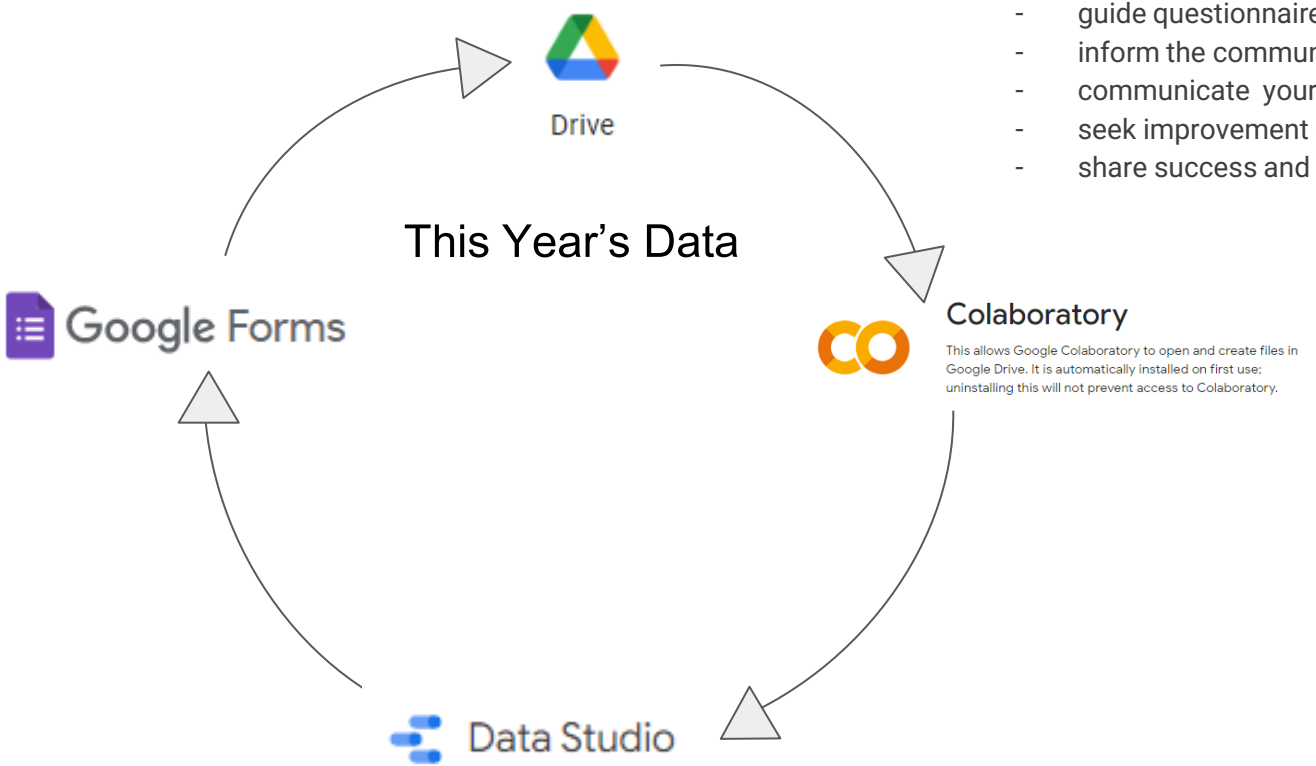
This Years Survey Cycle



Future Survey Cycle



Future Survey Cycle



Can we do it?

We cannot do it without you.

- identify data opportunities
- guide questionnaire development
- inform the community about your engagement
- communicate your challenges
- seek improvement and grow together
- share success and spread experience

Future Survey Cycle

Do you feel it?

We all do!

It is not Burn-out.

It is Burn-in!

Talk about it.

Can we do it?

We cannot do it without you.

- identify data opportunities
- guide questionnaire development
- inform the community about your engagement
- communicate your challenges
- seek improvement and grow together
- share success and spread experience

“It's not the load that breaks you down,
it's the way you carry it.”

- Lou Holtz

Participate

Fill out one of the data working group surveys:

- Maker
- Leader
- Organization

Join a Makerspace

Nation of Makers tracks over 1500 makerspaces (>90% in USA)

https://www.nationofmakers.us/find-a-maker-organization

https://www.nationofmakers.us/find-a-maker-event

Join Nation of Makers or Become a Sponsoring Member

Join our Nation of Makers today!

Your support benefits the entire maker community. Together we can:

- Develop an accurate picture of the US and global maker movement
- Create impactful national partnerships and programming
- Widely share robust resources and information about the maker movement
- Advocate for increased federal and local support
- Maintain our grassroots heritage as makers and doers

Help us facilitate a vibrant large-scale, open-source crowds
between maker organizations and the public that goes beyc
one organization can achieve.

BECOME A SUPPORTING MEMBER

https://www.nationofmakers.us/join

https://www.nationofmakers.us/join/#membenefits

Membership *benefits*

As a supporting member of the Nation of Makers, your organization will have access to:

Visibility

- Have public recognition as a Nation of Makers member organization
- Have a supporting member organization profile and your logo prominently displayed on the Nation of Makers website
- Have your organization's resources highlighted on the Nation of Makers website
- Have your organization's events listed on the Nation of Makers National Calendar on the Nation of Makers website

Resources

- Have access and the ability to contribute to the NoM Resource Library with full attribution
- Have access and the ability to contribute to the maker job listing board (coming soon)
- Have access to funding resources and the support of a national organization as you apply for funding resources (i.e. **Members are eligible to receive Letters of Support for funding applications*)

Exclusive Benefits

- Occupy a key maker community leadership role by proposing projects for development by NoM
- Be able to join Nation of Makers project teams and actively contribute to Nation of Makers project plans
- Enjoy members-only exclusive networking, partnership opportunities, and voting rights
- Receive invitations to attend exclusive members-only events and participate in NoM publicity and communications
- Receive members-only discounts on NOMCON, our annual convening, and on tools and supplies from our affiliate partners

BECOME A SUPPORTING MEMBER TODAY

Call to Action - Use Cases Exemplifying Maker Capabilities

Coordinate manufacturing community efforts to advocate for new opportunities to promote access to capital (i.e., grants), and programs for manufacturing entrepreneurs, job training for manufacturing workers and investment in innovative manufacturing technologies.

Supply chain integrity is paramount

- Defines the assets & competitive advantages
- Knowing capabilities is key to deploying an organized framework.
- Provides a consistent, unified approach

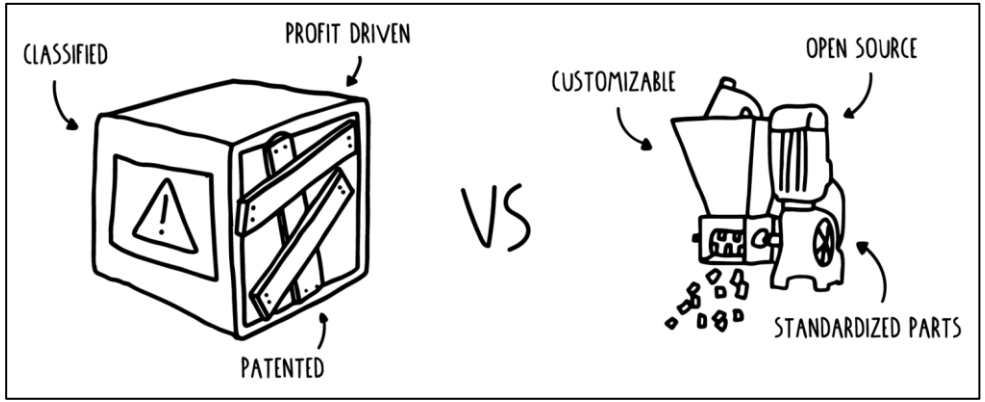
Use Case 1: Thermoplastic Recycling

Because the domestic supply of ABS and PC thermoplastic sheets and pellets is abysmal, international relationships are required to procure ‘new product’ and 40 week lead times.

“Everyone is a recycler. You can start or join one of these Precious Plastic spaces in your town and start tackling the plastic waste problem. Right now!”

Collecting, Sorting, Cleaning, Pelletizing, Melting & Fabrication, Repeat. - *a circular Economy*

Most commercial processes require thermoplastic pellets.



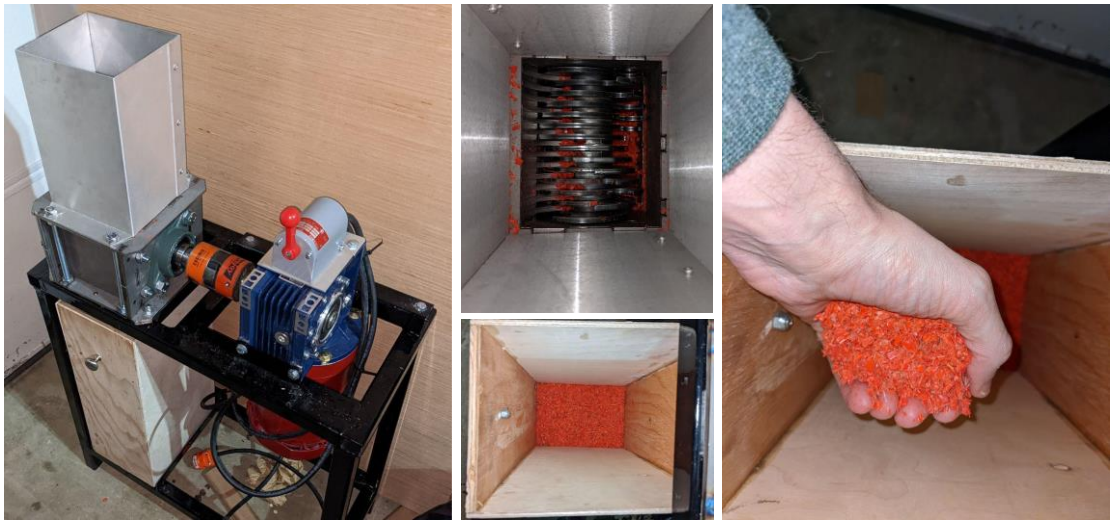
Thermoplastic Product Manufacturing

Prepared for Flight's *sustainability group* has a program for recycling scrap materials and non-conforming thermoplastic products.

NovaLabs in VA contributed melted face shield components in the summer of 2020 to kickstart this program.

Things we can do with pellets:

- Injection molding
- Casting
- Lathe (i.e., pen blanks)
- Extruding (i.e., 3DP filament)
- Direct sales



Pelletizer procured from https://www.preciousplastic-usa.com/machines

Use Case 2: NoM Challenge Coins

Nation of Makers was unable to identify a vendor who is able to produce these in the USA. The design is straightforward for a 1.75” two-side design coin.

Vendor comments:

- “...because you can’t do electroplating in the USA outside of hiring union folks to do that work, no one in the USA who makes challenge coins actually manufacturers them here.”
- “It would be 3-4x the cost to produce coins in the USA - if any factories actually existed that would do it. “

Front

Back

Quick CAD

Challenge Coin Manufacturing

Prepared for Flight is creating a workflow to produce challenge coins this summer through its *sustainability group* using recycled materials and DIY chemical plating processes (and appropriate safety procedures)

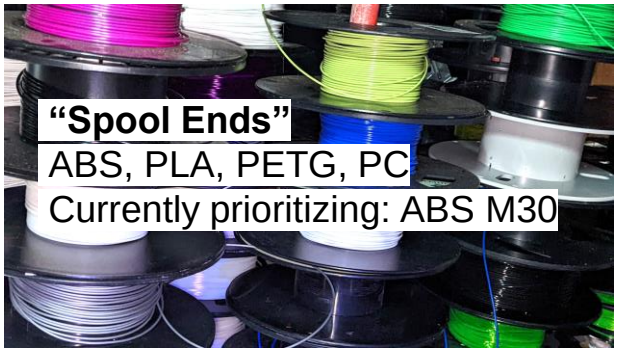
- Bronze, brass, aluminum, zinc casting
- Enamel paints
- Electroplating, electroless plating

Images show the basic requirements of metal casting:
source metal, propane casting furnace, flask mold, ingot mold, ingot

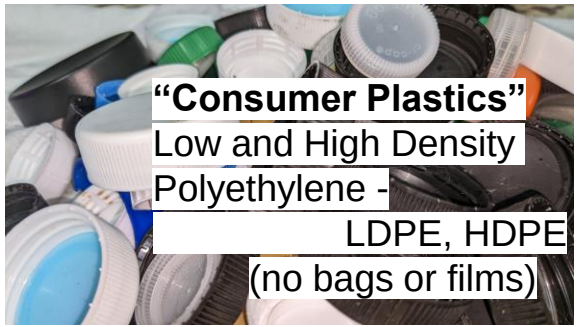
Sustainability Group & Prepared's Manufacturing Collective

Contact info@p4flight.com for the collection address. Instructions will be provided so we can track your contribution on our leaderboard with credit given to you or your makerspace organization. Contributors will have access to a *sustainability marketplace* in the future.

Non-conforming Prints
i.e., failed 3D Benchies



"Spool Ends"
ABS, PLA, PETG, PC
Currently prioritizing: ABS M30



"Consumer Plastics"
Low and High Density Polyethylene -
LDPE, HDPE
(no bags or films)

"Commodity Metals"
Aluminum, Copper Alloys
i.e., can tabs, heatsinks

What should we put on the 2021 coin?

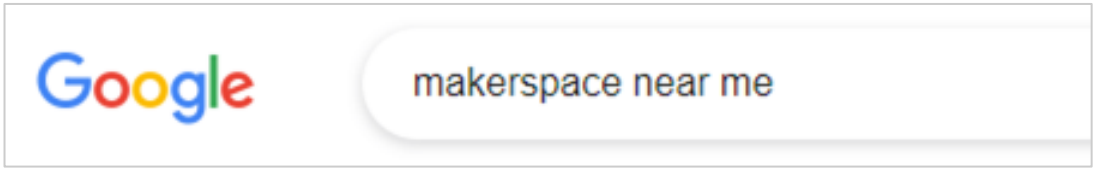
The NoM map is on the 2018 coin. The "We the Rosies" project is on the 2019 coin.

Submit your suggestion on the coin post on the @makethedata instagram page
OR email your suggestion to data@nationofmakers.us

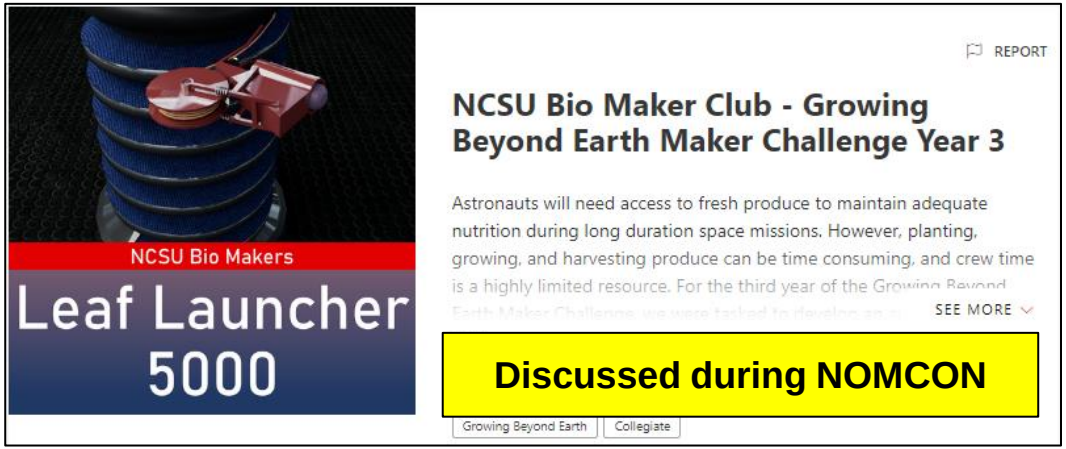
Goals and Actions

- Data-centricity through Thought leadership: Mentorships, training, coursework
- Connect new makers to an existing community full of resources, enabling them to grow and pass their knowledge on.
- Establish relationships, initiating new collaborative efforts for makers who are already strong and viable but who may be looking to branch out further.
- Meeting creatives, helping them find resources and educating them on business
- Unite the community, offering support, guidance and opportunity and raising awareness
- Foster collaborations for innovation, fabrication technology, and research through making
- Promote efforts to create a sustainable creative community

Call to Action - Meetups & Competitions



https://www.nationofmakers.us/find-a-maker-event



Showcase Competitions

Challenges and competitions foster great thinkers and problem solvers who identify new ideas that lead to new technologies that solve *global* problems

- Adam Winsor, a freelance designer brot art and energy together, by winning the Novalabs Energy Contest, he crushed the stigma that solar energy systems had to be a choice of efficiency over beauty.

New ideas leverage best practices and standardized workflows and become exemplars for real industry traction

Transformative efforts led by individual makerspace members can be a catalyst for other successes

The Deep Space Food Challenge, a NASA Centennial Challenge, seeks ideas for novel food production technologies or systems that require minimal resources and produce minimal waste, while providing safe, nutritious, and tasty food for long-duration human exploration missions. Solutions from this challenge could enable new avenues for food production around the world, especially in extreme environments, resource-scarce regions, and in new places like urban areas and in locations where disasters disrupt critical infrastructure.

The panels resemble mosaic tiles, like stained-glass windows at a cathedral, but they're also efficient in producing solar energy. The designs landed Winsor a finalist spot in the **American-Made Solar Prize, a $3 million competition held by the Department of Energy** to encourage entrepreneurs to advance solar research and product development, open to private companies, universities, organizations and individuals.

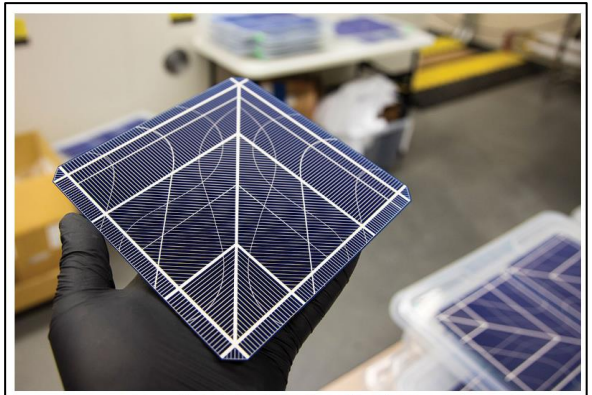


Photo courtesy of Adam Winsor, Mirimantis, LLC

Observations & Conclusions

Common Data Requirements:

- Standardize inventory management systems, product management, etc.
- Facilite “Intellect Sharing” where thought leadership can be shared digitally across physical boundaries
- Real time gap analyses through access to instant reporting that can highlight your most important channels and identify the ones that will require improvements.

Observations & Conclusions

A steady flow of information and collaboration across all stakeholders of the supply chain is missing at the very core of our supply chain networks. Removing barriers and creating a path toward the uninterrupted sharing of data will help the nation secure our manufacturing industry. Additionally it will address many of the challenges and bottlenecks we are encountering in our nation’s supply chain network.

A transformative data-centric approach offers resiliency by providing supply chain visibility and mapping and ensures business continuity.

Leveraging data increases our ability to detect and respond faster to problems while increasing our effective supply chain capacity.

Observations & Conclusions

Makerspaces involve a lot of moving parts, and it can be time-consuming and complex but it is manageable with the right leadership. Prepared believes NoM has that leadership and we are sponsoring them to continue to provide opportunities, services, etc.

Digital Transformation will continue.

Data focus should be proactive not retroactive.

“Making” *is not* limited to small widgets - makerspaces have abilities to do electronics, automobiles, avionics, advanced materials engineering, etc., and as such, it shouldn’t be hard to envision manufacturing easily taking place in the domestic market.

References not embedded in these slides:

Helpful Data Tools

https://www.census.gov/topics/business-economy/manufacturing/data/tools.html
https://www.census.gov/topics/business-economy/manufacturing.html
https://www.census.gov/topics/business-economy/manufacturing/data/economic-census-business-demographic-data.html
https://www.census.gov/library/visualizations/interactive/export-markets.html
https://www.census.gov/library/visualizations/interactive/bfs-by-state.html
https://bds.explorer.ces.census.gov/

2021 Members Report

https://datastudio.google.com/reporting/366fbf47-f284-4a48-b025-65b684ce9a00/page/p_lsl36rzruc