

Highlights

@GT-IDEA

Intersections

The changing landscapes of
healthcare, cybersecurity,
customer service



INDIANA UNIVERSITY

BLOOMINGTON

Kelley School of Business

O'Neill School of Public and Environmental Affairs

Luddy School of Informatics, Computing, and Engineering

Welcome note

Colleagues,

During the 2019 Spring Semester, Grant Thornton LLP, a leading professional services firm, gifted Indiana University \$3 million. This gift established the Grant Thornton Institute for Data Exploration for Risk Assessment and Management (GT-IDEA), an interdisciplinary institute that spans across IU Bloomington's Kelley School of Business, the O'Neill School of Public and Environmental Affairs, and the Luddy School of Informatics, Computing, and Engineering.

GT-IDEA is aligned with the core vision of Grant Thornton's Advisory Services' consulting practice, which is driven by technology and data analytics to help businesses achieve long-term sustainability, create value, and solve problems through innovation. Students who participate in the GT-IDEA program gain experience working on real-world industry issues by utilizing data-driven technologies, engage in case studies and competitions, and benefit from interactions with established risk assessment and management practitioners from Grant Thornton.

This innovative approach to learning is designed to prepare students to become the next generation of even more effective industry leaders. It has also deepened Grant Thornton's relationship with IU, allowing the firm an opportunity to recruit deserving students who are well-versed in risk assessment and management.

I personally invite you to join this growing and vibrant GT-IDEA community through our various programming events that will help you prepare to be the business leaders of tomorrow. And, I look forward to seeing you during my next visit to Bloomington!

Sincerely,

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Deans welcome notes

The GT-IDEA program brings together three Indiana University professional schools—the Luddy School of Informatics, Computing, and Engineering, the O'Neill School of Public and Environmental Affairs, and the Kelley School of Business—to foster ideas and collaboration across a range of areas and topics such as healthcare, cybersecurity, and customer service. In many of these areas, impact is maximized by evaluating the technical, public, and policy viewpoints collectively. At the Kelley School, our faculty and students are deeply engaged in business applications of digital technologies and data analytics. That is what makes the GT-IDEA program very unique and exciting.

The Luddy School of Informatics, Computing, and Engineering (SICE) is delighted to participate in the GT-IDEA program. At its core, SICE is a school built on collaboration among disciplines and, at IU, schools. SICE is one of three schools, with the Kelley School of Business and the Maurer School of Law, to offer an innovative, interdisciplinary MS degree in Cybersecurity Risk Management. SICE also houses the Shoemaker Innovation Center, a 3,500-square-foot space dedicated to nurturing innovation and entrepreneurship at IU. The center is available to all IU students, and many Kelley School of Business and O'Neill School of Public and Environmental Affairs students participate in programs at the school. Thus, SICE has the experience and infrastructure to foster cross-disciplinary partnerships, which is one of the primary reasons for the creation of GT-IDEA.

In the time that GT-IDEA has existed at Indiana University, it has worked to develop a sense of community among its constituents at Grant Thornton, the O'Neill School of Public and Environmental Affairs, the Kelley School of Business, and the Luddy School of Informatics, Computing, and Engineering. By bringing together IU faculty and students with Grant Thornton business leaders, cross-disciplinary synergies have improved not just the student experience, but the experience of all involved. Hundreds of participants have gathered at the Bloomington campus for GT-IDEA events, from the faculty banquet for our Grant Thornton Scholars to our conference and case competition. One case competition winning team, comprised members from all three schools; remarked that they never would have collaborated without GT-IDEA. We are excited to explore the possibilities for further developing this community as time progresses.

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What Events Does GT-IDEA Support on Campus?

Since its launch in the spring of 2019, GT-IDEA has actively engaged students from the Kelley School of Business, O'Neill School of Public and Environmental Affairs, and the Luddy School of Informatics, Computing, and Engineering. We've held roundtable discussions, case competitions, data jams, and conferences. GT-IDEA engages faculty from the three schools in various student-facing initiatives, as well as networking events with Grant Thornton business leaders.

Each academic year, there are six roundtable events featuring a business leader from Grant Thornton who engages in a discussion with students from the three schools. Each school hosts one roundtable discussion per semester that provides information relative to the student competitions and additional networking opportunities.

There are also two case competitions and a data jam each academic year. These events encourage students to use an interdisciplinary approach to real-world problems. During the competitions,

students have an opportunity to be mentored by Grant Thornton business leaders, as well as Luddy, Kelley, and O'Neill faculty scholars. Each competition culminates in a conference that explores the competition themes.

Faculty workshops are hosted by the Kelley School of Business in the spring semester each academic year. These provide a great opportunity for Grant Thornton faculty scholars and business leaders to network with each other.

Faculty webinars are hosted twice per year. These webinars allow Grant Thornton and the Luddy, Kelley, and O'Neill faculty to share their research with Grant Thornton in an online and interactive environment.

The coming academic year will be filled with exciting events and opportunities for students, faculty, and Grant Thornton business leaders to connect across disciplines, build relationships, and share expertise. We hope you are looking forward to it as much as we are!



January 24, 2020

Presented by:



Lisa Walkush, Principal,
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Sharif Ambrose, Principal,
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Life Sciences and Healthcare Trends: Disruption with an Eye Toward Opportunities and Risks

Lisa Walkush, Principal, Advisory Services and National Life Sciences Sector Leader, Grant Thornton

We're going to talk about trends we're seeing in our respective areas—life sciences and healthcare. First, we're going to look at life sciences.

Our life sciences sector at Grant Thornton is focused on connecting people and professionals who work in the industry, not only in our advisory practice, but also across tax and audit. We are focused on helping our clients support patients, provide better solutions and better therapies, and run their businesses more efficiently. To do this, we look at the life sciences industry across the value chain and work with clients in various functional areas including research and development, clinical development, regulatory, quality, manufacturing and supply chain, and commercial.

Aging population

An aging population is creating a larger patient base for the life sciences industry, and the demand for products and therapies is growing. The 65-and-older population will continue to increase by 3.3 percent through 2024, and the amount of medication people take when they reach age 65 to 75 increases dramatically. With the therapies on the market today, people are living longer, and baby boomers are aging. The aging demographic equates to more people in need of medication, driving revenues in the pharmaceutical industry. The pharmaceutical industry alone is expected to reach \$1.4 trillion. From a consulting perspective, there is a significant opportunity to help clients develop their products.

Patent cliffs

There is a patent cliff coming that has the potential to make a \$200 billion impact on the industry. Most of the products involved are large-molecule or biologics. Humira is the highest-selling product on the market today. Its patent expiration is being extended a little bit, but when that happens, products that are called biosimilars—which are the generic version of biologics—will become available.

The US Food and Drug Administration has an accelerated pathway to get biosimilars to market, but the adoption in the US has not been as high as in other parts of the world. This is partly because some of these products are being litigated before they get to market. Because biosimilars are less expensive than biologics, patients would benefit. We're hoping that as this new patent cliff hits, we will see more of an uptick in adoption.

Restructuring to drive down cost

Life sciences is a big industry, and it's very mature. There is not a lot of revenue concentration. There are a number of big players in the space and they tend to focus on different therapeutic areas, but there is some competition. There is also a decrease in margins coming from pricing pressures. Our clients are always looking for ways to grow their businesses and save anything they can from an expense and cost structure standpoint. We're seeing this a lot in R&D. We recently worked on a feasibility study for a client that looks at different ways the procurement group could leverage existing group purchasing organizations (GPOs), buying groups, and consortiums. It was a one percent savings—we did a ton of research. They're trying to save anything they can, especially in generics.

Regulatory environment

The global regulatory environment in this industry is extremely complex. We speak with the FDA and watch guidance documents that come out, but things tend to change quickly. We're trying to help our clients leverage artificial intelligence and machine learning to manage questions from different health authorities around the globe, pull that information in, and get it out to the right people in the business so they can get submissions in and make better decisions faster.

Drug pricing

Drug pricing tends to be one of the top issues in the industry. The current administration has issued a blueprint with certain suggestions to get

controls in place in the United States. One of these suggestions is to look at pricing for certain products domestically and internationally to see if something can be done to align them. Other initiatives are being proposed, but because [2020] is an election year, everything is on hold.

Immunotherapies

Gene therapy and CAR T cell therapy will lead the way and push new business models, including pricing. We work with a number of clients that have drugs on the market to treat cancer. Immunotherapies are truly helping patients, but there are struggles with pricing and reimbursement. Right now, these technologies are available, but private payers tend to make them a third line of treatment—even if they're

more effective—because they're more costly. Hopefully that will change.

Trade negotiations with China

A number of our clients are targeting China as a top growth market for 2020, so we're watching the tariffs and trade negotiations. Phase one of trade negotiations affected agriculture the most. Phase two may impact the pharmaceutical industry more, because a significant amount of active pharmaceutical ingredients come from China.

New molecular entities (NMEs)

A record number of NMEs were approved by the FDA in 2018, and there was a similarly high number in 2019. We're watching what happens in 2020, because NMEs are an indicator of innovation.

Healthcare disruption and innovation

Erik Shannon, Healthcare Sector Leader for Strategy and Performance, Grant Thornton

We'd like to talk about the disruptions and key innovation areas in healthcare today. We see healthcare as inclusive of delivery, management, and financing—of hospitals, physicians, and any way of providing healthcare and health plans.

Author Thales Teixeira wrote, "Disruption starts with unhappy customers, not technology." It's all about solving problems for the customer. Sometimes you don't know you have a problem, and an innovation emerges. I didn't know I needed a really thin mobile device for all of my music, for example. Other times, you just know you have a problem.

The higher the percentage of people—or customers—who say, "this is a real problem for me," the more likely it is that there will be disruption.

As of August 2019, the pharmaceutical industry scored a net -31 percent in a Gallup poll that asked participants whether their overall view was positive, somewhat positive, neutral, somewhat negative or very negative for business sectors across the US. Healthcare scored net -10 percent. The pharmaceutical and healthcare industries were among the three worst-scoring business segments in terms of public opinion.

Given these numbers, people want change in healthcare. So what's changing now that would potentially be a reason for true disruption?

Complexity

If someone buys a Starbucks coffee, that person is making the decision about where to go, what

coffee to order, and how much they want to pay for it. In healthcare, a highly skilled physician tells you where to go have your surgery, and what medicine to take. At least three different organizations pay for these things, which muddies the waters.

Provider fragmentation

If you look at concentration levels of different industries—with the exception of health plans—healthcare providers are extremely fragmented. Part of that is due to the existence of nonprofit hospital systems. There is a cultural barrier against merging from a financing perspective.

Proprietary/closed systems

If we look at proprietary/closed systems, we have to ask ourselves: How transparent is the data? How free-flowing is the information around that?

Regulation

It's a highly regulated industry, and that certainly puts rules in place that create limitations.

Game changers that may disrupt healthcare

Patient financial responsibility

There's a significant move toward consumerism in healthcare. As patients pay a much higher percentage for their healthcare through their insurance premium, coinsurance, and rising deductibles, they are more empowered. Healthcare organizations are moving toward the how-and-when-we-want-it approach.

3.3 PERCENT

growth the 65-and-older population will experience through 2024, creating a larger patient base for the life sciences industry

\$200 BILLION

potential impact of a looming patent cliff on the life science industry

Consolidation

There's been rapid consolidation that has meant large healthcare systems are now considered medium-to-small.

Standards and interoperability

Regulations are a wild card. But if people are unhappy with legislation made by our regulators, they're going to try to experiment and push more.

Nontraditional entrants into healthcare

Another catalyst for potential healthcare disruption is that some of the world's largest technology players have entered the digital healthcare market. Apple, Facebook, Amazon, Google, and Walgreens are among the players who are already communicating with millions of users annually and developing apps to guide care.

Health innovation funding. Where's the money in healthcare?

Private equity entered the healthcare space during the financial crisis because of good returns, and the fact that it doesn't matter what the economy is doing—there's always a need for healthcare. Investments today center around digital health and patient empowerment (helping people navigate healthcare). Firms are investing in smaller companies and ideas. One hot industry is autism clinics—every state has regulation saying that autism care is a required benefit. Because there is funding, there's a race to build clinics.

CEOs and COOs are coming from retail and applying ideas to the retail of healthcare, including how to digitally interact with customers.

Customer focus

There's a laser focus on solving problems with patients at the center—not the provider, not the pharmacist. Consultancies like Grant Thornton have developed entire practices around customer-centric approaches and methods to help solve problems.

Patient access and readiness

Government healthcare providers are somewhat different than commercial healthcare providers in that they are mandated to provide care in every corner of the US, no matter where, and regardless of the population. This creates tremendous challenges. Military Health and the VA have begun to rely more on private sector providers and contracting with networks to provide the same care.

About 10 years ago, this represented about 10 percent of care—now it's 35 percent and growing. That policy shift began toward the end of the Obama administration and has accelerated under

this administration. One day, the majority of care for these patient cohorts will not be provided in military or VA hospitals, but in other settings.

High Reliability Organizations (HRO)

HROs are somewhat unique to federal healthcare. They are organizations that experience fewer than anticipated accidents or events despite operating in highly complex, high-risk environments. Healthcare fits that bill. When you think about these enterprise organizations, the quality is high in terms of customer service, administration, and clinical care, but the consistency of quality and effectiveness isn't always there. HROs are meant to create the consistent, high-quality organization that federal healthcare really embraces.

Learning healthcare system

The government wants to evaluate ongoing transformations and make iterative changes to improve through a learning healthcare system model.

Innovation in government healthcare

Sharif Ambrose, Principal, Public Sector for Healthcare, Grant Thornton

The best way to talk about the innovation that government healthcare has contributed to the industry in the last quarter century is to give a few examples:

- 70 years ago, the National Institutes of Health (NIH) pioneered clinical trials to test new drugs.
- In 1958, a couple of doctors from the Buffalo VA Hospital invented the first transportable pacemaker.
- In 1984, government healthcare invented the smoking cessation patch.
- In the 1970s, the Department of Veterans Affairs—the largest provider in the US with over 1,000 points of care—collaborated on what was then the most sophisticated enterprise-wide electronic healthcare record, later to be known as VistA. They developed the core medical record, applications for the specialties, and then, when the technology became available, the integrated imaging.
- In 2000, the federal government recognized its purchasing power from a pharmaceutical standpoint. A million patients spent an excess of \$100 billion a year on care for those in active military duty and their families. The federal government negotiated very large contracts with two of the larger pharmaceutical suppliers—McKesson and Cardinal Health—to provide pharmaceuticals to their patients, greatly decreasing the cost of medication and cost of care for those cohorts.
- In 2010, engineers and physicians at the

Indianapolis Medical Center invented the first vertically-standing wheelchair, which allows patients more mobility and dignity—an example of consumer-focused problem-solving.

- In 2012, the Centers for Medicare and Medicaid Services (CMS) developed a pilot program called Accountable Care Organization (ACO). This is one model that helps with care costs in the US—providers and hospitals base their reimbursement on health outcomes when a patient's treatment is finished, not on the services they provide. It started as a government health Medicare program, but there are some commercial health plans that are in the pilot phase of this innovative approach to efficiently managing care.
- In 2014, government healthcare providers began providing telehealth services to patients to address rural care and access issues in a meaningful way. Government healthcare is recognized as the foremost provider of telehealth services.

If you're wondering if there's innovation in government and government healthcare, we hope this convinces you that there certainly has been.

So, what's happening now and what's going to happen in the near future? Federal healthcare is facing some of the same trends that were discussed earlier, and leveraging technology to overcome those challenges.

What will foster new disruptions in healthcare?

Integrated electronic health record (EHR)

Every community and major health system is using the integrated EHR, and almost every clinical practice. Today, government healthcare systems are investing \$50 billion to replace the health record innovations they made 40 years ago. The EHR is a great innovation from a workflow and interface standpoint for clinicians.

Sophistication of wearables

We used to think it was cool that we could check our pulse on our watch. Now the sophistication of wearables is increasing exponentially. Pacemakers can provide information about the state of your heart. Home health devices can help manage chronic conditions and transmit data to a clinician 100 miles away. Federal healthcare providers are embracing this as part of their telehealth strategy.

Internet of Things (IoT) and 5G

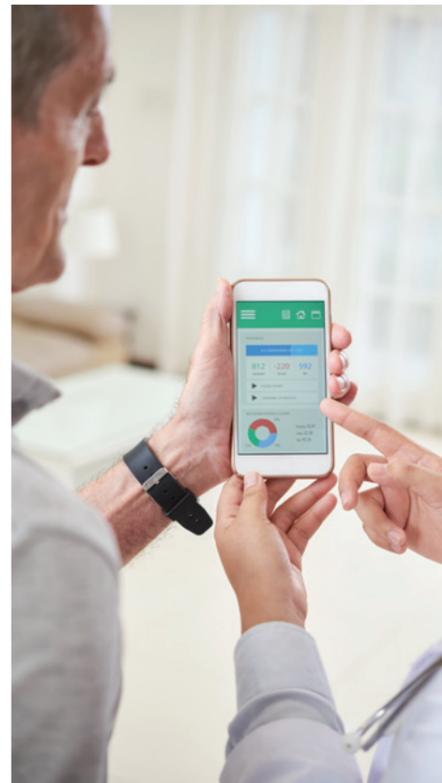
IoT and 5G are all over the news right now and will certainly have a big impact on healthcare. By 2022, IoT will be a \$410 billion market for healthcare alone. Devices will communicate with each other, not just the enterprise system, to help better manage chronic conditions, diagnose ailments, and help doctors understand how treatments are working.

Focus on adoption and customer experience

As a consulting firm, and as a business and technology consultancy, we advise clients that they have to have an adoption strategy. None of the technology matters if they don't have a strategy to adopt the change. Each one of the things we've discussed is a solution that solves a problem today, but it has to be part of an integrated solution over the long haul.

The complications in healthcare are many. We all play a role and there are many levers to pull. The important thing is that consumers are at the center of the model. We, as individuals and organizations, must think about what our role will be in helping healthcare transform to reduce costs, improve outcomes, and increase patient safety and effectiveness of the treatments available.

At the end of the day, our work at Grant Thornton is all about patients, and the students we're working with through the GT-IDEA program are working on real-world problems like these for clients. We look forward to continued collaboration.



10 PERCENT

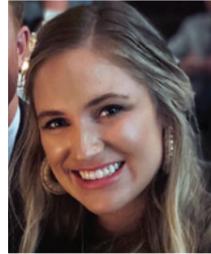
of care came from government healthcare providers **ten years ago**

35 PERCENT

of care comes from government healthcare providers **today**

October 21, 2020

Presented by:



Taylor Fay, MPS

Manager, Health and Social Services, Grant Thornton Public Sector LLC

Fay supports federal health agencies to achieve their mission. She's currently leading a strategic engagement at the Centers for Disease Control and Prevention within the National Center for HIV/AIDS, viral Hepatitis, STDs, and TB.



Reem Ghoneim, MPH

Manager, Health and Social Services, Grant Thornton Public Sector LLC

Ghoneim leads the development of the public health community of practice at Grant Thornton. She has experience analyzing public health issues related to health research, minority health, social determinants of health, and health policy analysis. Her core areas of experience include health system strengthening, organizational change management, strategic communications, business process improvement, and pharmaceutical supply chain management.

Operation Warp Speed: A Sheer Declaration of Intent

News and information about COVID-19 vaccines and Operation Warp Speed have continued to rapidly develop since this presentation was given on October 21, 2020.

Introduction

Professional development: Self- and social awareness

Taylor Fay (TF): Reflection and awareness are expected parts of continuous professional development that improve practice in all disciplines allied to public health, including healthcare management and administration. Self-awareness will allow you to identify with your own and others' emotions and behaviors, where social awareness will help you stay culturally competent and understand the reasoning for health outcomes across different populations.

Reem Ghoneim (RG): As you may have all experienced during this pandemic and public health emergency, material and physical resources are stretched thin, leaving the needs of those who may need them the most unmet. This group is referred to as a vulnerable populations. The most vulnerable consists of those who are unable to access the resources needed to effectively prepare, respond, and recover from emergencies.

To better understand the health risks of these vulnerable populations, we need to understand their social determinants of health. These social determinants are environmental conditions in which we live, learn, work, play, worship, and age. They affect a wide range of health, functioning, and quality-of-life outcomes and risks.

To make it a little bit more relatable: do you have access to educational opportunities? In this group, we all do, and obtaining higher education serves as a protective factor that expands your economic opportunities and gives you access to information and financial resources that help you better take care of your own health and the health of your loved ones. Our health behaviors and social determinants are also shaped by our social and ecological context at the institutional, community, and policy levels, as well as the inter- and intrapersonal levels.

During a pandemic such as COVID-19, the social determinants of health and health disparities are seen pretty clearly with social distancing, for example, and access to healthcare being a privilege and out of reach for people like the homeless, those who are housing insecure, those with limited food security, or others that live in rural areas, for example. Inequities around economic stability, neighborhoods and environment, health and access to care, social and community support, and education all directly and indirectly affect our health outcomes and how resilient we can be during a pandemic like COVID-19.

Some of the relevant risk factors that people may face at the societal level include inequities in accessing healthcare or policies that don't support workplace flexibility. On the other hand, some societal protective factors or policies, such as the mask orders that were implemented at the state level, or state immunization program requirements for schools and child care centers, have helped reduce the spread.

TF: Operation Warp Speed, or OWS, is a government-wide collaboration led by the Department of Defense and the Department of Health and Human Services. The initiative was first publicly announced back in May, 2020. Its main objective is to accelerate the development of a safe and effective COVID-19 vaccine and deliver 300 million doses to Americans by January 2021. The current record for vaccine development is four years, and that was for the mumps. If this turns out to be successful, all of us here can say that we witnessed a pretty historic record-setting pace for vaccine development, which will probably set a precedent for future vaccines.

So far, the federal government has invested about 10 billion dollars in OWS, with most of the funds allocated to support up to 800 million doses of COVID-19 vaccine candidates proposed by companies you've probably heard in the news: Moderna, AstraZeneca, and Novavax. There are 17 partner organizations working together and in parallel to achieve OWS's mission. The FDA, CDC, and NIH are operational divisions within HHS, and

are basically leading research providing vaccine candidate approval and performing distribution, prioritization, and oversight. Logistical support is something the DoD brings to the table, and that includes the ability to secure supply chains for manufacturers of vaccines, as well as program management, contracting, operational planning, and IT experience.

Biomedical Advanced Research and Development Authority (BARDA) is an office within HHS, and its role is to specifically lead the development between government and industry of vaccines, drugs, and diagnostic tests. Some of these pharmaceutical companies are supporting vaccine development since the federal government is eliminating the barriers to entry for drug companies. There are quite a few collaborations taking place in vaccine candidates put forward to increase odds of a successful vaccine by 2021. The federal government only chose one vaccine distributor to keep everything centralized in terms of the data and logistics, and that is McKesson.

Before we consider OWS's accelerated timeline, let's consider the timeline for a normal vaccine process. The overall development of a vaccine consists of five phases. Before a vaccine is licensed and brought to the market, it undergoes a very long and rigorous process of research, followed by many years of clinical testing. Normally, the number of vaccine candidates quickly declines between the first phase and the third phase. This is largely due to how expensive it is for pharmaceutical companies to undertake this process. One misstep can result in a drug company having to stop the vaccine development process immediately—in some cases they have start back at square one, which is extremely costly.

Rather than eliminating steps from the traditional vaccine development timeline, steps within the OWS's accelerated timeline proceed simultaneously. This increases the financial risk, but not the product risk. Manufacturing during a normal vaccine development process comes after clinical trials have completed, but for OWS, manufacturers are already working on those vaccines so that right when the FDA gives us that approval distribution activities can technically start the next day.

There are 100 to 500 quality control tests each vaccine candidate must undergo during its manufacturing journey, which represents about 70 percent of the manufacturing timeline. While the aim is to distribute 300 million vaccine doses by January 2021, we are still doing clinical trials. Four of the drug companies just entered their third phase of their clinical trials this month, so vaccine delivery does not just come to your doorstep. There are several phases that go into it and a lot of work to be done, going forward.

While the federal government says it is solely and willingly taking on a great amount of financial risk, there remains a ton of uncertainty on how this is all going to work. A successful national rollout of the COVID-19 vaccine comprises five key determinants that require immediate attention and commitment from not only the administration, but also community leaders. A roll out grounded in transparency, integrity, and trust will instill—or restore for some—nationwide confidence in the intentions and competence of the healthcare system.

The five determinants of a successful rollout of the COVID-19 vaccine

1. Safety and efficacy

An accelerated COVID-19 vaccine process has introduced significant safety concerns amongst Americans, particularly vulnerable populations. While the FDA will approve a vaccine for use, if it is at least 50 percent effective, reluctance may lead many to still forego vaccination altogether, if safety concerns persist. In September, chief executives of nine drug companies made statements about their commitment to safety and efficacy standards, but it's not as simple as just making these safety pledges or public-service announcements. Vaccine development is a complex social endeavor that needs deep engagement on a human level throughout the entire clinical trial process.

There remain many unknowns regarding each COVID-19 vaccine candidate's effectiveness and longevity: Will the vaccine guarantee infection prevention for a few months, a few years, a lifetime? How will

second doses be issued and monitored? Vulnerable populations such as pregnant women, young children, and individuals with noncommunicable diseases are excluded from clinical trial trials to reduce the risk of severe adverse effects. How will these vulnerable populations be protected? There are also populations that choose to not participate in clinical trials due to long standing distrust in the healthcare system. Mortality rates related to COVID-19 for Black populations are twice as high as they are for White populations, yet they make up a very small percentage of clinical trial participants.

In the path forward, drug safety and surveillance, clinical trial safety management, and pharma co-vigilance should be established and adhered to. This will ensure proper safety reporting procedures, institutional review boards, regulatory authorities for patient protection and safety, and the integrity of clinical trial results. Drug companies must also continue to be consistent and honest throughout the clinical trial process in order to build—or rebuild—trust with vulnerable populations or those populations who have long-standing distrust in the healthcare system.

A vaccine can technically be approved by the FDA if it is at least 50 percent effective. While this may seem low, it can carry other health benefits, such as a reduction in hospitalizations. If there is a fairly low efficacy rate, a larger percentage of the population needs to have the COVID-19 vaccine administered. For example, if there is an efficacy rate of 50 to 60 percent, a large percentage of the population needs to be willing to get the vaccine in order for life to go back to normal. Alternatively, if you have an efficacy rate of 100 percent, then you only need 50 to 60 percent of the population to get the vaccine in order to establish a healthy level of immunity.

2. Screening and selection

RG: Wide acceptance and uptake of the vaccine is needed to make sure that we have the right populations in the studies. According to COVID-19 epidemiological data that we've seen across the country, there are really large racial and ethnic disparities in the incidence and mortality rates. In New York City, 75 percent of all frontline workers are people of color, including 82 percent of

cleaning services employees. More than 40 percent of transit employees are Black, while over 60 percent of cleaning workers are Hispanic. At least 123 transit workers in New York City have died from the virus. These are the people that are working on the front lines who don't have the ability to stay at home to work.

There are disproportionately higher rates of COVID-19 infection, hospitalization, and death among people of color, but they are significantly underrepresented in the COVID-19 clinical trials. In the nationally funded, adopted COVID-19 treatment trial, which tested the efficacy of the antiviral Remdesivir, Black Americans accounted for 20 percent of the total patient population. In the Gilead-funded clinical trial for the drug, roughly one out of every ten patients given Remdesivir was Black. Latinx and Native Americans comprise 23 percent of the former trial and less than 15 percent of the latter. The overwhelming majority of the patients in both of those large clinical trials were Caucasian. A lack of diversity in clinical trials is a long-standing problem that has persisted despite federal laws mandating the inclusion of minorities in government-funded research. Given the higher level of media attention around the COVID-19 vaccine, there has been a greater push to include minorities in the studies and use this as an opportunity for change.

One way to improve vaccination among critical populations is for the jurisdictions at the local level to ensure that these groups have access to vaccination services. Partnerships with trusted community organizations that we all might access, such as pharmacies, community and rural health centers, and schools can help facilitate this process.

3. Supply distribution, and administration

The medical supply chain data in the U.S. is lacking overall. We have suffered a PPE shortage throughout this pandemic and the fundamental reason for that is a lack of transparency in the supply chain. Because we have a private, decentralized healthcare system, there is no central agency or repository on the national health supply chain level that collects that type of information. Manufacturers are not required to, and do not, report supply chain

information to the FDA, or even to the hospitals that they serve as their customers.

Implementing effective vaccine management strategies can allow manufacturers, suppliers, distributors, and healthcare providers to maintain greater storage capacity, reduce any wastage, and accurately forecast vaccine requirements for an overall improvement in supply chain performance. The supply chain system isn't resilient or agile, so it really can't withstand the uncertainties of an emergency situation like a pandemic. A successful immunization program relies on the supply chain and logistics. This would require us to achieve the six "rights" of supply chain management: The right product in the right quantity in the right condition at the right place at the right time and for the right cost.

Then there is the issue of administering the vaccine. Will we have enough? Where do we store this vast number of vaccines for the public? And how do we properly store it without impacting the efficacy of the vaccine? Vaccines generally require cold chain practices and equipment. One of the COVID-19 vaccine candidates requires ultra-cold temperatures, and freezers that reach, minus 70 degrees Celsius. These are rare to find at hospitals in wealthy countries.

Digital disruption can help address some of these issues So can using human-centered design practices and behavioral economics. Assessing different personas, developing journey maps, and involving different stakeholders in the supply chain process can help provide a more consumer-focused approach to the vaccination program. Dashboards and transparent reporting are critical—these provide the data that we need to improve the supply chain systems' performance.

OWS released its distribution strategy [in September 2020], highlighting some key tasks to ensure access to vaccines for all Americans. In order to promote vaccine uptake and public trust, communication on public health information throughout the distribution process is essential at the national, state, tribal, and local levels. High-risk populations, such as frontline workers and the elderly, will be prioritized to receive the vaccine. Actual allocation



methods will be based on an equitable mechanism, given the disproportionate mortality rates that these groups have suffered. Distribution needs to take place immediately after the emergency use authorization and the biologics license application are granted. This will be done using a phased allocation methodology.

OWS is working to ensure access to the vaccine, and the availability of administration or ancillary supplies, such as syringes, needles, and vials. It's important to be able to bring patients back in to get that second, booster dosage to ensure the high uptake rates necessary for the vaccine

to be effective. Capturing and monitoring data from the vaccine program is also necessary to track the distribution, administration, and pharmacovigilance (which has to do with recording adverse events or side effects to the vaccine).

There will be a phased approach to the distribution and administration of the vaccine, largely based on a finalized prioritization plan, which will be announced closer to implementation. The Centers for Disease Control and Prevention (CDC) has an Advisory Committee on Immunization Practices work group which will develop recommendations for the prioritization of

the vaccine. In the first phase of the distribution approach, there will be limited doses available and implementation will be targeted around reaching the most vulnerable and critical populations. In the middle phase, vaccine availability will expand and be administered to the wider population. Efforts will be focused on getting high uptake rates and reaching large populations. In the third phase, if COVID continues to be a public health issue, there will be a continuation of the vaccination program. The vaccine will then become universally available, and integrated into the routine vaccination program, much like we receive our flu vaccination every year.

4. Public faith & participation

All of the scientific, administrative, political, and financial work behind this vaccine is not applicable if we don't get people vaccinated. In order to gain faith in participation, there must be trust between the American people and the activities that are ongoing with OWS. The novelty of COVID-19 introduces hesitancy around the vaccine, and this hesitancy is exacerbated by the sociopolitical climate, inconsistent communication, and safety concerns. Recent issuance and revocation of the FDA emergency use authorization raised concerns of lower regulatory standards for vaccine approval.

A successful immunization program relies on the supply chain and logistics. This would require us to achieve the six "rights" of supply chain management: The right product in the right quantity in the right condition at the right place at the right time and for the right cost.

On the other hand, we have a historical record in the United States of mistrust of the medical community in government, due to events such as the infamous Tuskegee Syphilis study of 1932, and the 1976 Swine Flu outbreak. Those put the credibility of public health agencies at increased risk and take generations to repair. In early September, the Kaiser Family Foundation released a survey that revealed 62 percent of adults believe political pressure will lead the FDA to approve a coronavirus vaccine without making sure that it's safe and effective. Decisions need to be based on the facts, on science, and on the involvement of our communities and stakeholders in this process of developing a successful vaccination program.

5. Communication

TF: The spread of misinformation around the gravity of COVID-10 has been even quicker than its spread. Effective and timely communication is crucial to resolve uncertainty, especially in a time of social media. It's important that the communication methods across jurisdictions used today are consistent and grounded in transparency. Varying interpretations in media coverage on the COVID-19 vaccine influence vaccine perceptions, attitudes, and decision making. To effectively share information related to the vaccine, credibility in science must underpin every message, and each message should only come from trusted leaders within the community. Vaccine manufacturer and administration data must also be documented and forthcoming. Communications change with the context of the science, so it's critical that the public does not feel like there is backtracking to correct mistakes, but more importantly a path forward towards better accuracy as the data and science progress.

Public health external agencies and community partners must also utilize standard communication and educational resources to accommodate those with varying levels of health literacy. Older adults, medically underserved people, minority populations, and those with low socioeconomic status may benefit from different methods or channels of communication to fully understand the

risks. Without cultural competence, complete transparency, and timely information sharing, individuals will remain in the dark about where, when, and how to get the vaccine safely.

We put together "The Fauci Communication Framework." Dr Anthony Fauci's method of communication serves as a good example, as he consistently follows four guidelines when communicating to the public—not just about the COVID-19 vaccine, but about the pandemic in general:

1. Here's what we know based on the current data
2. Here is what the models are showing
3. Here's what we don't know, and need to find out
4. Here's what the public should do

The communications around mask wearing serve as an example of how ineffective communications may impact health outcomes. At the start of the pandemic, public health officials did not recommend wearing a mask. At the time, we didn't know the efficacy of masks, but we did know that we were at high risk of a shortage, which would put even more of a burden on the healthcare system. At the time, mask wearing was discouraged for the public in order to protect a group more vulnerable, or at higher risk to contracting COVID-19—our frontline workers. The initial lack of transparency and contradicting messaging around masks, has had a lasting impact and now, nine months later, there's still discussion about the efficacy and safety of masks. While mandated mask wearing is in place, adherence to mask wearing still varies. Even though Dr. Fauci has made public statements that explain this, it's important that we understand that decisions and things that we communicate are all relative to the science. It's okay to keep moving forward and changing the dialogue as new information comes about, in terms of efficacy.

While OWS aims to respond to an unprecedented pandemic in the 21st century with record development and delivery of a safe and effective vaccine, there remains uncertainty and risks to overcome in order to achieve a successful national rollout.

Leadership commitment and diligent stakeholder coordination across jurisdictions is required to address all these elements around vaccine, safety, efficacy, and supply chain. A successful national rollout of the COVID-19 vaccine that addresses all of these determinants and stays grounded in the three guiding principles of integrity, transparency, and trust is what we need in order to uphold the public's faith in the competence and intentions of the American healthcare system.

COVID-19: A public health awakening

RG: COVID-19 has brought to light the existence of the concept of the social determinants of health, but the public health community has been studying it since the early 2000s. These factors always existed, and they need to be taken into consideration. The vaccine itself is not a silver bullet, and we still need to address these issues at the core to reduce some of the disparities that we've seen.

The future of health equity

COVID-19 and OWS give us an opportunity to revisit the health inequities that impact everyday lives. The pandemic can serve as a chance to improve health equity by reducing disparities; implement public health intervention and vaccination programs; address social determinants, such as bias and discrimination; and affect how we recruit, engage, and treat ethnic and racial minority groups that are disproportionately impacted by the virus. At the federal, state, and local levels, every strategic plan should have clear goals and performance measures around health equity in order to be held accountable.

Without the partnerships of the communities that are the most impacted, we will not even come close to our goal of health equity. As the future generation of public policy makers, healthcare administrators, and leaders, please remember to look outside your own self and deeply know the communities that you serve—you are part of them too. This way we can see real change towards true health equity.



Spotlight: Case competitions

GT-IDEA hosts three case competitions throughout the year across our three schools (the Kelley School of Business, O'Neill School of Public and Environmental Affairs, and the Luddy School of Informatics, Computing, and Engineering).

Case competitions are designed to simulate real business problems.

Students work on interdisciplinary teams with students from all three schools. Additionally, teams are paired with IU faculty mentors and business leaders from Grant Thornton while working through the case. The competitions culminate in conferences where the competition finalist present their solutions and keynote speakers explore the case themes.



Telehealth in the US: GT-IDEA Faculty Workshop

SPECIAL SECTION: HEALTHCARE

January 29, 2021

Presented by:

Christopher Baratta,
Partner in health care practice

Sajeed Chowdhury,
Director

Alaina Capanna,
Experienced Manager

Nicolette Guillou,
Manager

Elizabeth Berwaldt,
Senior Associate

Maddie Dolz-Lane,
Associate

Christopher Baratta: The concept of telehealth originally came about because companies wanted to reduce spending. They started platforms that allowed you to call in and speak to a nurse practitioner or another clinician to get things done via the telephone, so you didn't have to pay money to see your actual physician. Telehealth has changed a lot since then—it has grown exponentially due to COVID and changed a lot of the way we're delivering health care. There's a lot of innovation going on alongside this growth, such as the emergence of wearable health tracking devices, which also poses some threats, since that is not always the most secure way to store information.

Nicolette Guillou: We hear a lot—especially in this COVID environment—about digital health apps and patient-facing technologies that are promising to disrupt the health care industry. But there are very strict guidelines from the Centers for Medicare and Medicaid Service (CMS) around what is permissible and what will actually be reimbursed. The signaling and guidance from CMS is important because it's ultimately what commercial payers look at to replicate and extend throughout the industry.

There are two main buckets of services that can be provided in telehealth—synchronous and asynchronous. Synchronous includes real-time visits where you're looking at your doctor on a screen. These can also be audio-only visits or virtual check-ins, which are just kind of a quick touch base around care coordination. Asynchronous types of care, such as messaging with your provider through your patient portal, are also used to build care continuum outside of the clinical setting.

Telehealth can extend health care interactions and has kept patients, providers, and families connected through COVID. We've seen a massive surge in delivery of telehealth services. Many of us, myself included, probably used telehealth for the first time through the COVID pandemic. We've gotten some interesting snapshots of health service data around what telehealth utilization has looked like since the start of the pandemic, starting around March of 2020 through early fall. Telehealth remains a relatively low percentage of all baseline health services—it peaked around April [2020] at just under 14 percent. Providers are now focusing

on finding the optimal sweet spot for telehealth provision. Some are thinking about building out a "virtual first network" or "digital front door" concept, in which some patients' first contact with a system is a telehealth or virtual visit. Within this concept, chatbots, algorithms, or a human on the other side of the screen helps the patient find the right point of care and connects them to it.

During COVID, certain specialties have demonstrated the proof of concept for virtual care and telehealth—especially primary care and mental health. We expect that that trend will continue.

Telehealth has really shown that it can provide good mental health care for populations that need it. One example is the Veteran's Administration—which is the largest integrated health delivery system in the United States. Their ability to impact and drive population health outcomes using technology is immense. They looked to solve a very specific population health problem within their patient cohorts using technology. They used a very targeted, focused approach, centered on patients who may live in rural areas and may not be connected to a traditional primary care team. They connected them with a virtual behavioral health team first, which would follow up on appointments, check in with them, and make sure that they're adhering to a care plan. The VA was able to see great outcomes with this pilot project and have continued to expand tablet delivery to veterans through partnerships so that they stay connected to their care teams. Other health systems across the nation are starting to emulate and replicate what the VA did.

But part of the reason telehealth has surged so dramatically in the post COVID environment is that it had a lot of regulatory help. Significant regulatory easing through the COVID pandemic has allowed new service types to be provided—as well as new points of care—that allowed patients to receive telehealth visits at home instead of an approved facility location. In the past, many of these services have not been reimbursed. If the CMS payment is not aligned with services, the cost is significant.

A group of legislators recently made recommendations to sustain telehealth provision in the post COVID period—most of them involved maintaining the temporary emergency provisions

around services that are allowed and where and how services can be provided. There's going to be a major focus on evaluation of telehealth provision during this time period, so that future policy can be based on where support is needed. Looking specifically at geographic population health outcomes and disparities for care will be really important to make sure that the regulation that moves forward is impactful and supports a high quality and safe delivery system.

The future of telehealth and digital health care delivery

Sajeed Chowdhury: A year ago there was less than one percent utilization of telehealth services across the industry. Now, it has skyrocketed because of COVID and everyone is scrambling to get their act together from a people perspective, process perspective, and technology as well.

Christopher Baratta: If you think about technology innovation in the health care space, health care providers are way behind. In clinical innovation, we're always trying to figure out how to cure cancer and things of that nature, but the fundamental technologies that drive a hospital system or a physician network are very poor compared to everything else that we use.

When COVID hit in mid-March, it was a struggle. For the first 30 to 45 days, medical providers across the nation were having complex problems: Were they going to use their phones or their cameras to communicate with patients? Did their patients have enough internet bandwidth? It was bad, and it's gotten better, but they haven't done a really good job of trying to figure out how to measure what is working or not. There are a lot of lessons learned. We're still trying to figure out the clinical efficacy of those telehealth visits so that they work from a technology perspective and allow for better focused care. We're still trying to gather data.

I think we will see some sustainability. I don't think we're ever going to go back to one percent, but I don't also think we're all going to go 100 percent virtual either. There are certain situations where a patient needs to be in the same room with their physician. Some of these new changes could have longer-term benefits, like helping the Medicare population overcome its unwillingness to see a doctor. The patient might not be able to attend the routine annual visits that are usually required. Telehealth can solve a lot of that. Now that the elderly population is getting a bit more used to it—because they were kind of forced to use their technology—it's a good opportunity to check in with them.

On the mental health side, someone might not feel like getting up, getting in their car or other form of transportation, and going to see someone. Telehealth makes it a lot easier to just call in or click in and talk to someone. Telehealth will be a core part of how we're going to deliver medicine now—how much that's going to be is what we have to figure out.

Expanding the telehealth services spectrum

Sajeed Chowdhury: Between now and 2030—over the next 10 years—our senior citizen population, or Medicare population, is going to grow by 10 percent. From that perspective alone, certain segments of our population are going to be super users of telehealth services. So, again, I think this further emphasizes that it's never going to be one percent, and it also may not be 70 percent... it'll be a new norm.

We wanted to highlight a few organizations that are exploring and evolving telehealth, like remote patient monitoring. What happens when you hang up the phone or shut down the laptop? When there needs to be some sort of surveillance done 24-7, to take care of the patient and check their vital signs, that's remote patient monitoring. So Ochsner Health, for example, is partnering with Apple to integrate the remote monitoring data they are capturing through devices like the Apple Watch. By taking real-time data and connecting it to electronic records, clinicians now have access to patients both from physical visits and information collected 24-7 from the patient

Similarly—and this is a major gap right now—you may see a doctor, but then need to go take a lab test for an infection or something else. Mayo Clinic is doing a remote diagnostic initiative called Safe Health Systems where they look at infections like Strep throat and other ailments, to see if basic, low-complexity tests can be done remotely and shared with the clinician right away.

Indiana has a lot of rural population, and so does Massachusetts. Massachusetts and its neighboring states are working in partnership with Massachusetts General to provide telestroke services. One out of every 20 deaths in the U.S. is related to stroke, and every second counts when somebody is suffering a stroke. Telestroke programs allow rural areas and rural communities to get connected to large academic medical centers like an IU Health, where they have access to clinicians and specialists who can monitor their care. Essentially, market leaders have discovered

BEFORE COVID-19

There was less than one percent utilization of telehealth services across the industry

JUST UNDER 14 PERCENT

baseline health services that were telehealth by early 2021

ample opportunity in the fringes to help them better adapt and develop telehealth.

Private sector accelerating telehealth capabilities

There are a lot of developments on the fringes that telehealth market leaders are now pursuing. Mayo Clinic is partnering with Google around digital health analytics. Why? Google, like Amazon, deals with tremendous amount of data. They have core competency in analytics. Mayo is collecting a lot of information and data through their telehealth services. As a result, Google can help Mayo turn the data into practical, usable information that allows clinicians to take better care of patients. ChristianaCare is working with Amazon—Alexa, is going to be your doctor soon. In other words, Alexa will soon act as your doctor by reminding you to take medication, follow medical advice, and attend future medical appointments.

Teledoc is an example of a market leader in telehealth services that have enhanced their capabilities. Rather than being simply a network of clinicians and providing telemedicine services, Teledoc recently merged with Livongo, a company specializing in chronic conditions like diabetes and heart disease. They are integrating various data and other services into their platform and partnering with hospitals to deliver that care.

Christopher Baratta: Amazon and Apple and Google are now very interested in health care—there's a lot of money in health care. And Amazon is a major disruptor—Amazon disrupted the shopping business. We went from malls to online shopping, and the other thing that they disrupted was the shipping business. UPS and FedEx now are threatened by Amazon with its own fleet of drivers and trucks and even planes. So, there are people in the health care industry that are trying to figure out how to realign so that they don't get stepped over. They are concerned that these companies are now focusing their attention on health care, because they have a history of disrupting that business and challenging it and making it into something different. When Amazon, Google, and Apple start thinking about health care, something is going to change and it's going to be very different than what we've known before.

Looking beyond telehealth to virtual health services

Sajeed Chowdhury: Wearables are one of my favorite topics. I'm wearing my Apple watch today. A lot of us don't always realize that we're already wearing wearables. Some of the other wearables

that are out there already in the market include the smart ring. It's slightly bigger than a wedding band and it measures your oxygen level in your body and how it is flowing. This is important for sleep apnea, congestive/heart related diseases, and respiratory illnesses—making sure that blood is flowing through your system properly. This is a constant data feed into your medical records that your clinicians can get especially if you are a high-risk individual.

Smart belts are another example—I'm trying to pick some of the more obscure wearables. Smart belts are used for epilepsy. They are not that intrusive, and can help immediately when a patient is suffering, or about to suffer a seizure. It sends an immediate warning and notification to clinicians and care providers for assistance. Those split-second notifications can potentially save people's lives. Another interesting one is smart shoes, which are used for individuals who have musculoskeletal or nervous system issues, so their posture or gait is compromised. The smart shoes capture all that information as they are walking and provide that information to the clinician.

Virtual Reality (VR) technology that would allow the clinician to provide an immediate diagnosis is also being developed. That is not too far out in the distant future. Using VR technology is already in place today. In fact, Geisinger is already using VR technology today for therapeutics. And so, it is very likely, with Amazon and Google and all of these disruptors coming into the market in the next couple of years, that you will be wearing a lot of wearables, and you will be notified real time, through your watch, through your phone, or by other means, that your blood pressure is going up a little or your glucose level is up a little bit, and so you need to do A, B, and C. With your permission, your care provider will be notified immediately. Hypothetically, that submission may immediately send any medication necessary to your closest pharmacy for you to go and pick up. These things are not in the distant future—they're happening now in a lot of places, and it will be more common and prevalent very soon.

Threats to continued telehealth adoption

So, let's rein back and come to reality a little bit. No one on our telehealth team is a cybersecurity expert, but I wanted to share some of the stats around cybersecurity and health care. Health care, as an industry, has two times more breaches than any other industry, and this is pre-COVID. With the exponential rise in telehealth adoption, health care



Mayo Clinic is partnering with Google around digital health analytics. Why? Google, like Amazon, deals with tremendous amount of data. They have core competency in analytics. Mayo is collecting a lot of information and data through their telehealth services. As a result, Google can help Mayo turn the data into practical, usable information that allows clinicians to take better care of patients.

organizations and people in general are using devices and technologies that are not very secure. When you're exchanging informational data and PHI data over the Internet, it better be secure, otherwise you are very likely to be hacked. That is the biggest risk right now to telehealth from an adoption perspective. As hacking increases, will providers, consumers, or both be discouraged by the threats of telehealth?

In January 2020, there was literally a data breach per day. By December 2020, the number jumped to two data breaches per day. Each data breach is estimated to cost nearly \$7 million in combined data and reputation perspectives. Cybersecurity continues to threaten health care as it relates to consumers, patients, and organizations.

Future directions students may consider

Maddie Dolz-Lane: Although telehealth faces many obstacles, one cannot deny the telehealth market brims with potential growth. Soon, we will need more research and analysis to discover what is necessary to drive development, new policies, and best practices.

One of the greatest strengths created by telehealth is the opportunities it allows for both consumers and stakeholders to jump on board and adapt to the future of health care. The Biden-Harris administration offers great inspiration in terms of telehealth policies and grant funding.

One more advantage of telehealth is its inherent ability to create interdisciplinary collaboration opportunities. The technology

aspect of telehealth might appeal to the interests of students at both the Luddy School and the Kelley School, while policies and regulations might interest O'Neill and Kelley students. This meshing of interests sets the stage for the creation of a diversified team around telehealth.

Future policy makers might consider data privacy, which future tech whizzes might be allured by the AI and Internet of Things (IoT) components." Future business leaders may be curious about the profitability of long-term telehealth offerings, or private sector and provider collaboration that we touched on earlier. So there really is something for everyone in telehealth, and the opportunities to unite different disciplines through additional research and analysis make all the opportunities worth exploring.

Healthcare Systems: Navigating COVID-19

SPECIAL SECTION: HEALTHCARE

Summer, 2020

Presented by:



Erik Shannon,
Partner at Grant Thornton

How are healthcare systems navigating COVID-19?

I think health care systems have learned from organizations' experiences. These experiences can be applied across any industry.

We've talked to a lot of agencies that give bond ratings to organizations—they essentially gauge the health of a health care organization. What they really look at is how the organization has responded to COVID-19: Were they proactive? Were they flexible and creative? What were the lessons learned from that? What is the level of relationships that they've had so far with their employees and physicians? We have stories of conflict between management and clinical staff because clinical staff didn't feel safe, and these kinds of issues are likely to persist for a long time. We also have examples where there's been a great deal of cohesiveness during difficult, challenging times on the front line, where people have risen to heroic-type acts of caring for patients.

The agencies look at how healthcare organizations are handling COVID-19 spikes and waves, but also how they are planning and accelerating their reboot plans of getting back to providing care across the continuum to serve needs beyond COVID-19: How are they managing that aspect? What is going to be the volume for certain services, and staffing that appropriately? They're really interested in how healthcare organizations are becoming effective in predictive modeling their demand and their supplies.

Bringing clarity to uncertainty and change

As you know, there's just so much uncertainty and change in the environment right now. When I've talked to healthcare organizations, one chief financial officer of a \$6 billion organization said "In all this uncertainty, we're having this huge debate over how many people should we lay off. We know that there's going to be volume coming back. We don't want to lose those people. We want to protect those people, but we don't know exactly when that volume is coming back. And we don't know what we can afford around that."

There's a need to put structure and some clarity around that. In 2020, it's about handling COVID-19

and rebooting and restoring the organizations. I think in 2021, we're going to see a healthcare land grab, where there will be a lot of disrupters, a lot of competitors, and a lot of consolidation. There are some big indicators of disruption that is likely to bring about more consumer-driven healthcare in 2022 and beyond.

With that environmental uncertainty, it's helpful to rethink certain analytics and test old assumptions. When you go back to asking what the brand of healthcare is, trust is the ultimate factor. If you don't have trust in that healthcare organization and its providers, you've really lost everything. Right now, there is a lot of information out there from various sources, but providers are not necessarily the loudest or most amplified. I think there's an opportunity for providers to engage the community and patients, and brand themselves as healthcare becomes more consumer oriented.

COVID-19 market disruption

What's going to be next? Is there going to be another big wave of spikes or hotspots? We're starting to see some decent predictive models, and the blending of those predictive models, which are like the hurricane analyses that you see with the cone. But it needs to be geography-driven at the county and local level, because this pandemic is kind of a patchwork. It's certainly related to the different counties and states, but it's also very localized.

Beyond the geographic factors, social distancing is one of the most dependable drivers in predicting what's going to happen in that COVID-19 curve. The morbidity and socioeconomic risks embedded in that community are also important factors: Are people at higher risk because of certain chronic conditions and age levels? It varies quite a bit by location within our country. The other thing is super spreader facilities. There are certain facilities that had been super spreaders of COVID-19. As of mid-June, over 40% of COVID-19 deaths were either residents of long-term care or providers and workers in long-term care. The Centers for Disease Control and Prevention has measured hotspots of COVID-19, and almost half of those hotspots are within 15 miles of meat

packing plant. And as more industries, businesses, services, and institutions have opened, we're going to be able to identify other super spreaders. There are several things that we can look at to fine-tune predictability, short term, by geography. And all this change has certainly a lot of implications to the economy.

I also want to look at disruption from a mobility perspective. There is a lot of information out there that I don't think healthcare systems ever looked at before.

Google offered statistics from a national perspective that show the change from the baseline, in the January/February range versus June to mid-July. Over those six weeks, retail and recreation were down 17%, and transit stations were down 23%. Grocery and pharmacy were down 3%, but they are usually in that single-digit area naturally. The dynamic of decreased workplaces increased around residential.

In Indiana, we aren't seeing as much decline compared to the rest of the United States. Interestingly, the transit stations had gone up. I think that's probably because of when the baseline for the state was drawn. But, if I were in Indiana, I would want to look at infection rates very closely to make sure services aren't coming back too quickly. If you look at Florida, you can see retail and recreation down 26%, transit stations down 44%, even grocery and pharmacy down 13%. That is in keeping with what we've seen in other areas that have become hotspots.

There's even more detailed data from companies like Unicast that show anonymous cell phone traffic. As we've changed traffic patterns, we have to rethink what's happening and what those trends look like. For example, patients used to go to right by a particular clinic and those traffic patterns have changed. We can also apply data analytics to understand whether they are going by your clinic and going to a competitor and how long they stay there. There are all kinds of information that has become more important in predicting these things, in addition to the traditional aspects of weather, and other things, such as what sporting activities are people doing that may lead more to injury and urgent-type care.

We recently surveyed large healthcare systems. One of the questions we asked them was whether they anticipate another spike or wave of COVID-19 in the next 12 months, and 76% said they did. It was a much higher percentage for the urban and

Disruption (mobility mapping 7/12/20)

Social distancing and new patterns—current mobility

United States	Florida	Indiana
Retail & recreation -17%	Retail & recreation -26%	Retail & recreation -2%
Grocery & pharmacy -3%	Grocery & pharmacy -13%	Grocery & pharmacy +5%
Transit stations -23%	Transit stations -44%	Transit stations +14%
Workplaces -15%	Workplaces -21%	Workplaces -11%
Residential +3%	Residential +7%	Residential 0%

the rural healthcare centers. The suburban centers were a little bit more hopeful and a little bit more split about their thought process there.

Payer mix reductions from jobless rates

As people go out of work, they for a time period potentially have health insurance through COBRA, or they can perhaps purchase insurance on the exchanges depending on what state they live in. But ultimately, it cascades down, and they will either go to Medicaid or possibly self-pay. The reason that's so significant for healthcare systems is that for every 1% change over, there will be a change in the revenue. It's going to cut it in half or worse, and that will really hurt their margins, which are typically in the 3% to 5% range. Nearly 40% are thinking that there's going to be a change of payer mix of 4% to 10%, that's another significant factor that these healthcare systems are facing.

Profitable healthcare services plummet

As the COVID-19 volumes change, there's almost an inverse relationship with non-COVID hospital and physician volumes. And they are the profitable ones—elective surgeries are where the profitability is for healthcare. And during these times when there are higher COVID-19 volumes, with social distancing and potential lockdowns in place, then patients certainly will defer care. There are all levels of urgency and non-urgency. But our survey shows that 42% of patients are unlikely to be seen

67 PERCENT

of healthcare companies believe that they will sustain and grow telehealth volumes post-COVID-19

unless their situation is really serious. And 17% are not being seen even when they're sick or injured. Deferring that care creates the potential for more severe and complex cases later on.

In our survey, we see patient volumes going down significantly, revenues going down significantly in 2020—anywhere from 30% to 40%. Places that I spoke to that are kind of optimistic or haven't been as touched expect somewhere from 5% to 10%, which again—when your margins are 3% to 5%—are very significant changes.

This has meant that we've had hospital bankruptcies and closures already for 2020 through June. They are higher than any of the past 10 years. There are several factors that lead us to believe that this is going to continue to accelerate from bankruptcy perspective. For example, part of the funding has been giving loans by prepaying some of the services expected from Medicare, and just now, hospitals are starting to have to pay that money back, so there will be some continual strain.

There has been a lot of money provided through legislation like the CARES act, which has \$175 billion for providers and \$100 plus billion has been allocated. To put that in perspective, that's less than a month's worth of revenues for providers, physicians, and hospitals. If you look at the reductions in revenues that they had in March, April, and May, they've exceeded those levels.

So how do you predict specific deferrals of service and permanent referrals of service? There are actuarial models that we've been able to develop by looking at the most recent current data. We've looked at it from a standpoint of the maximum deferral—for example, there's a 60% reduction for surgical inpatient when there's a lockdown and

social distancing in an area. We'll never get 20% of that again—it's gone, for a variety of reasons. We have the opportunity to be able to be able to recover the other 40%. Overall, pharmacy has done fine—they've been in the 3% to 5% growth rate, even during the periods of lockdown and social distancing.

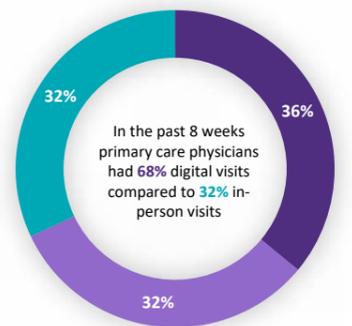
To incorporate these actuarial models and the other things that we need to think about, we need to look at the maximum amount of deferred care that could be recouped. We've been able to develop some pretty good assumptions based on early data that we will continue to refine. There are other things to consider, such as provider capacity. How much can they do? Can you have people work 50-hour weeks, 60-hour weeks—especially providers who are already weary from all the care that they've done around COVID-19?

An underlying factor that should not be ignored is mental health. The Kaiser Family Foundation did a study across the nation that breaks down data by state. The resulting information indicates that 37.8% of adults are reporting symptoms of anxiety. This is clinical anxiety and depressive disorder now, compared to 11% in 2019. The pandemic, the economy, and other factors all contribute, and it has some pretty important implications. Adding that third dimension—mental health—increases comorbidity complexities. It can potentially suppress patients from obtaining other needed care.

Digital transformation is a business imperative

We asked companies who led their digital transformation—the CEO, the CTO, or COVID-19? COVID-19 has pushed companies to do some amazing things. One of the questions we asked of

Primary care in the summer of 2020



■ Video ■ Phone ■ In-Person

78% of patients have means to access digital health

70% of patients are comfortable adapting to telehealth during the pandemic

69% of patients prefer to meet their doctor in person

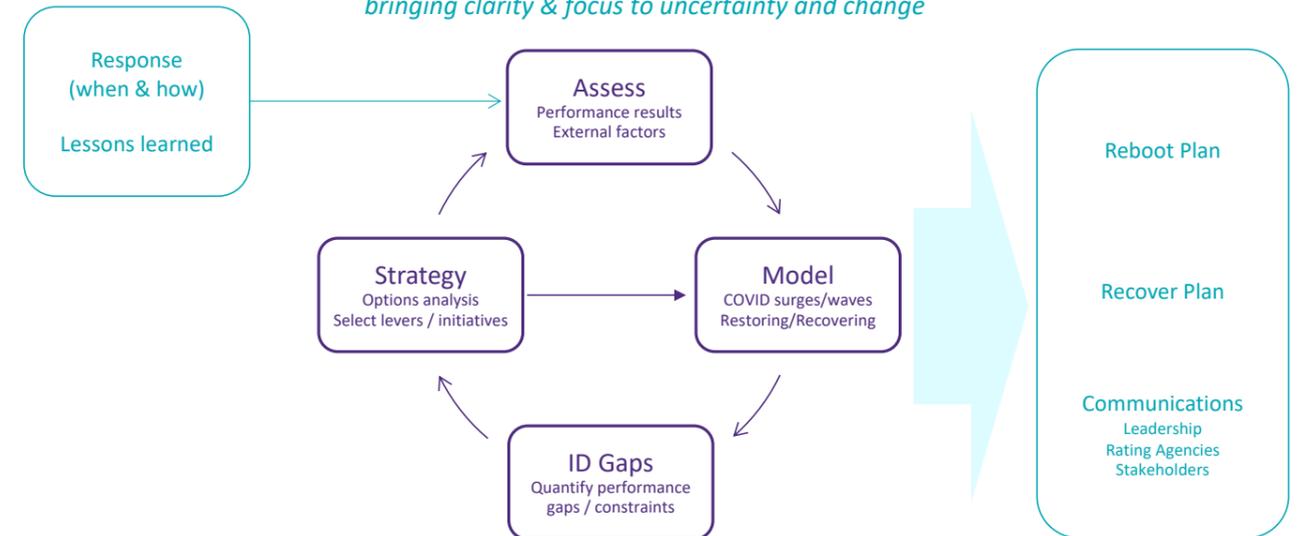
33% would leave current provider for a provider that offers telehealth

Telehealth adoption—early indications

Sources: Primary Care Collaborative and SGP & Black Book Market Research

Iterative Methodology

bringing clarity & focus to uncertainty and change



large healthcare systems was “what are your expectations around telehealth volumes?” We've all seen these huge increases in telehealth. It's had exponential growth at healthcare systems' physician practices. And 67% believe that post-COVID-19, they will sustain that, and predict that it will grow. Kaiser has been doing this for some time, and the foundation's view is that 60% of physician office visits in the future will be through telehealth.

Obviously social distancing has propelled this, but Medicare also made some big changes. They went from 103 services that were paid for in telehealth to an additional 135. They've also increased their payments, so a video telehealth visit has the same reimbursement as an in-person visit. Telehealth has been very effective with behavioral health, where it's become more common. However, we are now also using it for inpatient emergency room cases. I've talked to a lot of healthcare systems about this. It's very exciting. No one has it figured out and they are still figuring out the efficiency of when and how best to use this. Of the primary care physician practices that were surveyed, 68% of visits used telehealth. There's a comfort level for patients using it, as well as patients who are now converts who are saying “Hey, I'm not going back in my provider in the future if they don't have telehealth.” A fairly large

percentage of patients continue to prefer meeting their doctor in-person. We'll see how it works out, depending on how it gains traction and how effective providers are in smoothing out a lot of the kinks.

Our view is that telehealth is just one point of developing an integrated digital health strategy with patients, and it's a real opportunity. When you factor in the potential provided by integrating wearable technology, diagnostics, and efforts by Google and Apple, there exists a lot of potential disruption. I think this is where providers will need to decide how big of a bet they are willing to make as well as how to create a model that makes sense as part of an integrated care experience.

The other thing I wanted to mention is understanding the remote workforce aspect. I have clients that went from a handful of remote workforce to 4,000 people in three days. Another went up to 12,000 in week. What we're hearing is that they're not planning to bring those people back on site. They're seeing a lot of great things. There are some issues and things that they need to work out, and they're viewing it as a permanent shift.

Bringing it together

What we're seeing is retesting old assumptions. It's taking an iterative approach to how we are taking lessons

learned and how we are assessing performance results. We are figuring out new information and new ways of analyzing and adding information to form solid assumptions in order to model our restoration and recovery plans. We're also identifying gaps and quantifying those gaps to develop strategies about how we're going to fill them. That is the basis for a strong reboot plan—being able to make key decisions about keeping employees for a period of time or create reduction or furlough strategies based on the anticipated demand and services.

This also has to lead to action, depending on the lens a company is looking through. Are they looking at this from a restructuring perspective? Is it a stabilization strategy or a growth strategy? And even for those relatively healthy systems that have a lot of reserves—they view it as all three and an opportunity to change the structure of their organization. I think that's only the start. There are a lot of other new competitors, new moves, and new changes that are starting to happen.

It's an interesting time. I believe that all organizations are developing their digital approach, whether it's a restaurant or a healthcare system. They are looking at how they can develop trust and true engagement with their customers.

Why Customer Experience (CX) is Important to the Public Sector

O'NEILL CASE
COMPETITION



September 25, 2020

Presented by:

Rob Buhrman, Grant Thornton
Principal, Enterprise and
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Innovation.

Leader, IT Service Management
Service line and public sector
Commerce Account.

Client advisor and practitioner,
Digital Solutions offering.

Characteristics of excellent CX: Empathy, reliability, personalization, ease, calmness, and appreciation

Think about a time you had an excellent experience with either a product or service. What are the things about these products or the services that made that experience excellent? I usually use Uber as my example. I had a problem dealing with paying cab drivers. It wasn't the easiest thing in the world for me. I have a really bad wireless connection at my house, so a lot of times when I tried to pay with a credit card, it was very difficult or wouldn't work and I don't carry a lot of cash.

It's very easy to order an Uber and feel like it's pretty reliable. The personalization of the service actually tells me, "hey, you're in this city, do you want to go to the same place that you've been in before?" When I go to New York, Uber does that quite often. It's extremely easy to use—we talk a lot in the CX world about friction, and it's removed a lot of friction from the payment process. I don't have as much anxiety because I can see where the car is—I don't feel the way I did when I was worried that a taxi wouldn't arrive in time. I feel some appreciation because Uber asks me for my feedback—they're looking to continuously improve in my mind. You may not feel the same way about their product, but my experience is a good example of how a customer of a product can feel good about that product.

Defining CX

So, what is CX, exactly? Customer experience is really just defined as the perception that you have of a brand. That could be, how you experience it in a physical way, by going somewhere and buying something—having a transaction happen. It could

also be through a digital channel like a website or a cell phone mobile app. It could be through a call center, where you're asking for something or having a problem. It could also be through social media.

One of the things that the industry will tell you is that, especially for social media, negative experiences are eight times more likely to occur. People are eight times more likely to talk about their negative experience. There's currently a lot more attention paid to removing pain points or friction than there is to delighting a customer. Delight usually comes when your brand is all about exceptional service. The Four Seasons brand, for example, is about exceptional service.

In the federal government, we're a lot more focused on removing pain points, creating less friction, and making the experience better for the customer. Now when I say customer—in the federal government especially—we're not just talking about the citizen who's receiving a service. We're also talking about the employee. We do a lot of work for internal service organizations such as the CFO, the procurement shop, or the IT organization. Every single one of the employees who receives a service from those organizations is essentially their customer, so we have internal customers. There is also such a thing as a shared service organization, where one agency in the federal government supports other agencies. In those cases, the other agency is their customer. Then, of course, there are passports and trademarks and patents and other things, where the everyday U.S. citizen taxpayer is the customer.

Forrester Research defines what's important from a customer experience standpoint as three



dimensions, or the three Es. The first one is ease: "How much friction is there/how easy it is to get what I need to do accomplished?" Then there is emotion: "Did I feel valued and respected when I made that transaction" Lastly, effectiveness: "how effective was it?" If you do all these things really well but you don't give me what I asked for and the quality that I expected, then you really haven't done your job in the first place. These are the baseline for what a customer experience should be.

Why Prioritize CX?

Why should the government prioritize customer experience? In commercial organizations, it's clear. In the private sector, customers spend more money if they're satisfied and you give them a good experience. It actually costs 33 percent less to serve a customer if you're doing good customer experience, and you save money if the customer doesn't leave. It's 76 percent less likely that they will leave if you provide them with a good experience.

All these economic factors make CX really important to the private sector. But in most government organizations—not all, but in a lot—they are the single, sole service provider. You can only get a passport at the Department of State. You can only get a trademark or a patent at the United States Patent and Trademark Office. In a lot of cases, the government has customers that can't leave.

So why is it important for the government to focus on the customer? One of the key reasons is that it engenders higher trust in public service. If citizens have trust in a COVID-19 vaccination, for example, they're way more likely to want to participate, and then that gets us to where we want to go from a herd immunity standpoint. When there is trust in a government organization, it helps that organization achieve its mission.

Looking at a service or product through a customer lens means that you are no longer looking at it within your silo, and you are no longer creating fiefdoms within your silos. Organizations don't matter to a customer. They just care about getting what they want, getting it fast, and getting it done with high quality. They don't care that it has to be passed from one organization to the next organization. If you think in terms of the customer's journey, you're much less likely to worry about your organization. You're more worried about bridging silos between organizations to make that CX more seamless. It engenders greater productivity and reduces costs when you focus on the customer. The government has rules and regulations that we have to follow, including many new ones that are related to CX.

The Office of Management and Budget (OMB) recently revised its budget execution guidance. They've stated that organizations must establish a more consistent, comprehensive, robust, and deliberate approach to CX. OMB designated 25 federal entities (which can be programs within an agency) called "high-impact service providers." These organizations have a direct connection to the citizen and provide services to that citizen. They have to self-assess against a set of criteria, and then submit monthly action plans that illustrate what they're doing to improve customer experience.

The 21st Century Digital Experience Act was designed to improve the digital web presence for citizens and anyone else who uses a government website. There are a lot of newer requirements to improve standardization and accessibility. There are a bunch of data-driven improvements being applied to those web properties.

Another reason for the government to prioritize CX is because the cost of creating a digital product is incredibly high. They spent so much on IT, and there have been many studies about why IT investments fail. One of the things that that government organizations can do to increase the likelihood of success is to use CX techniques and concepts. If they are getting customer feedback along the way and refining their requirements on a regular basis, they're doing what we call design work. Then they have a 50 percent chance of reducing rework downstream, which is important because that 50 percent downstream is way more expensive than doing everything right up front.

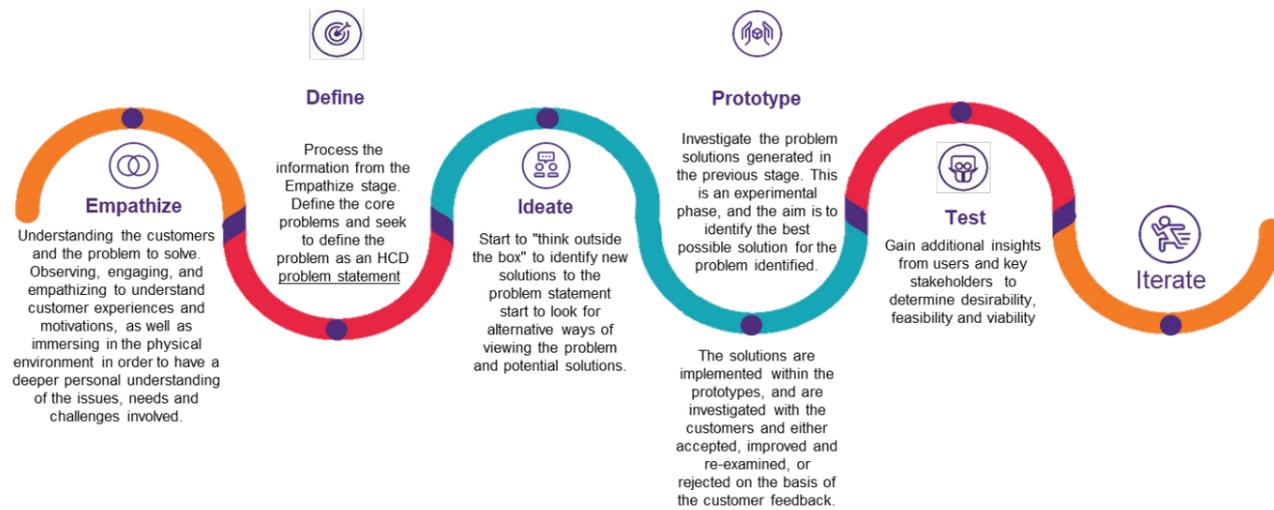
CX approach: Human-centered design

Human-Centered Design is an industry approach that is meant to help people think creatively. It begins with empathizing with the customer or user, defining the problem, ideating the right solution, doing rapid prototyping and user testing, and all these things are done in iterations. You are constantly, progressively elaborating your solution over time, with customer feedback throughout. That's how we do it at Grant Thornton as well.

CX tools and techniques

We use a handful of tools and techniques such as qualitative research. We do ethnographic research, focus groups, and interviews to draw out information about pain points in the customer's journey. We also do what is called customer segmentations and personas, where we really get an understanding of who the customer is, and what

Customers spend more money if they're satisfied and you give them a good experience. It costs **33 PERCENT LESS** to serve a customer if you're providing good CX.



their needs and wants are. Some customers might have more experience than others with the service, some might have less—they come from different backgrounds, so pinpointing that is important. Journey maps help us to understand their entire end-to-end journey. A lot of organizations measure a point in the journey—they might say “hey, we did a really good job of responding to that first call,” but they don’t understand why the person had to call in the first place. You’ve got to understand the whole journey and measure it in order to really understand what the customer’s pain points are. We also do Voice of the Customer (VOC) surveys, which include initial surveys, drop-in surveys, and digital surveys. You can do point surveys all along the journey to try and get more information.

Case study

Since we’re talking a lot about brand, I picked one of my customers, which is the United States Patent and Trademark Office. Trademark’s challenge was that they have gone through a modernization of all of their systems, particularly the systems that support applying for a trademark or a patent. In this case, the electronic filing system is the system you use to go through and apply for a trademark.

The modernization of this system has been in process for multiple years, and they kept having problems. There were poor user experiences, the fees were kind of high, they had some problems with inaccurate filings, so a lot of people were finding it very difficult and would abandon their application. We even had a member of our team who was

filing for a trademark who gave up and went and got a law group to help him through the process. They have policies and mission goals to improve customer experience, so they engaged us to help.

In the original eFile platform, there was an incredible amount of text with distracting colors and a confusing flow. An instruction video that was included was even more confusing. The one thing we really struggled with is that they would not allow us to remove a lot of language that they felt had to be there for legal reasons.

So, we took our human-centered design approach to help improve the site. First, we did some empathy mapping and developed personas of the different types of customers that use the eFile system. In some cases, they are single people—individual citizens—who are applying for a trademark and go it on their own. Then there are those who use a legal service to apply, and others from organizations like IBM or Google that have their own organization internally for trademark or patent applications.

Understanding the different nuances and needs and desires of these different types of personas helps us to understand where each one’s pain points are with the process. We then mapped their journey as customer, as well as the journey of the employee who was providing the service. We found that, in almost all the cases where the customer had a pain point, the employee also had a pain point. Employees didn’t feel like they could make a difference in improving that

pain point, even though they knew the customer was having an equally bad time with this process.

We then went through a process of ideation. We used a crowdsourcing application called Idea Scale that allowed folks that are familiar with the tools and the process to contribute to a virtual suggestion box for improvement. A lot of companies use the same kinds of tools for new features.

We also did some quantitative needs analysis and usage analytics to reinforce the potential solution. We then went and did some wireframing—over 200 screens. And this was great. I tell people all the time that a picture is worth 1,000 words and a wireframe is worth 1,000 requirements. If I can visually see how my system is going to work, and I can touch it, and click on it, and see how the workflow is going to happen, it’s easier for me to see that this is working the way I expected. It is an effective way to find a common understanding among business, legal, all of the stakeholders, and developers about how the solution should be built from a customer usability standpoint.

We took those wireframes and built a working prototype in Amazon Web Services and included a VOC tool. We then had users go through the product. Whenever they had a comment, they could click right on the screen and provide feedback—the tool even allowed them to do a screenshot. We were able to get user feedback very quickly to improve the tool. We found satisfaction with the experience, the ease of details, ease of filing, and the ease of creating an account.



Spotlight: Roundtables

GT-IDEA hosts **six** roundtable discussions each academic year. These roundtables feature speakers from Grant Thornton and cover a wide array of topics. Past topics have included ESG (Environmental, Sustainability, and Governance), Cybersecurity, and Healthcare.

Roundtable events provide an excellent opportunity for students, faculty, and business leaders from Grant Thornton to engage in and discuss trending topics.

Each of our three schools (the Kelley School of Business, O’Neill School of Public and Environmental Affairs, and the Luddy School of Informatics, Computing, and Engineering) host an event each semester. Students are welcome to attend all events. Roundtables are also a great chance to explore the other schools on campus!



Forensic Data Analytics

THEME: CYBERSECURITY



October 28, 2020

Presented by:

Johnny Lee, Grant Thornton, Principal and Practice leader, Forensic Technology Services



Meredith Murphy, Grant Thornton, Managing Director, Analytics Center of Excellence

Forensic Data services: What we do

Jonny Lee (JL): Our practice does essentially two things—forensic data analytics and cybersecurity work, which increasingly employs analytics. Generally speaking, it's the application of advanced technology to typically investigative agendas, and it is increasingly relevant in litigation contexts, complex compliance headaches, and regulatory inquiries.

I wanted to step through an overview of what we do, the technology that we think about and apply, and how we adopt what we refer to as an open architecture approach, which simply means that we don't presuppose a tool before we hear the problem or see the data. And then walk through some cases that help these things resonate.

Advisory analytics life cycle components

There are components more or less do—a continuum that includes data acquisition design, sourcing, validation, normalization, and modeling, followed by some combination of statistical analysis, data visualization, and reporting.

There is a quantum of data that needs to be sourced in our world from remarkably stubborn data sources such as legacy systems, things that may or may not have online backup media, or anything that isn't quite as handy as an active system that can just cough up a report. We often have to configure a design to identify the relevant systems before we source the data, and then cleanse and normalize it to render them trustworthy so that we can run the first useful query. The next steps may differ. Sometimes they involve modeling and complex "what if" analyses. Or they may involve higher-level math and deeper statistical analyses to make sure that the downstream outputs of our work are truly bulletproof and that those analyses are trustworthy.

In investigative contexts, we often have to explain complex and nuanced facts to uninitiated and nontechnical audiences, so data visualization has become ever more important to our practice. If done properly with trustworthy data, you can distill complex thinking and analysis into a select few graphical depictions that can be very compelling. At the end of the life cycle, there's some form of reporting. Sometimes that is a very involved written traditional narrative report, and sometimes it's a verbal relay to an audit committee or a regulator, or perhaps testimony.

Open architecture tools can be relevant, but we don't pick a tool until we see the data and know what we're wrestling with. If we're relatively sure of the provenance and cleanliness of the data, we might use a tool like Alteryx over a more traditional, manual approach with SQL Server. This has to do with expedience and cost management. But if we really have to do things at the level of rigor that might require us to testify about each handoff from sourcing to cleansing, from cleansing to normalization modeling, we're likely to stick with a more traditional SQL Server approach. The tool selection flows from the problem.

Advisory infrastructure

With that life cycle as context, the combination of the tool selection and the requisite infrastructure in which we run those tools becomes this sort of honeycomb exercise. How do we pick from the right items on the menu, knowing that we must be focused on data fidelity, and without overengineering any particular aspect of the work? Our clients don't appreciate paying for overengineered solutions, so it really becomes a balancing act.

One of the ways that we marry tools and infrastructure is through our experience. We are able to create a library of analytic accelerators, or pattern analyses, that we see over and over again. We have several hundred of these accelerators, which can be anything from snippets of code to full-blown algorithms that have been proven out in prior cases. None of them necessarily work out of the box on the new project, but all of them give us a frame of reference for the data elements we will need, what kind of chronological analysis will be relevant, and the agenda or reason we were hired in the first place.

We have this ability to pick and choose from a bedrock of established and proven analytics that accelerate the work that we do. The benefit is that you let the machine do what it's really good at, and you leave the analyst more time and more budget to do the higher thinking about what it means and contextualizing that for our clients.

We're professionally paranoid. We don't trust anything. We don't trust anything our clients tell us about their data. We don't trust anything about the ease of extricating the data from core systems. We don't trust anything. Because we are the ones that have to stand up and explain that to very nontechnical audiences and open ourselves up, sometimes in the form of cross-examination, to scrutiny at a really minute level of detail. There

are some contexts for which we're hired, where the turnaround, the rapidity of the response is more important than the pinpoint accuracy. Not every project is going to be subjected to cross-examination scrutiny or evidentiary admissibility issues.

Meredith Murphy (MM): Johnny and I have both worked within regulated industries, for the government, at the direction of and on behalf of governmental entities, as well as for companies. In all of those cases you have different access to data, and you're able to request and require different data. The facts and circumstances of the project and what you're investigating will dictate what you request and have access to. Generally speaking, we utilize waivers or contract language that allows us access while acknowledging that if we do not have the requisite access, we will not be able to perform our analysis to provide an opinion related to certain facts.

Fraud/Anti-Bribery Anti-Corruption (ABAC)

JL: ABAC is a specialized aspect of fraud analysis that focuses on things like the UK Bribery Act, or the Foreign Corrupt Practices Act—these focus on practices that are quite normal in certain parts of the world that are highly illegal in the U.S. There is a euphemism in the Foreign Corrupt Practices Act called a "facilitation payment," which, to most people, is also called a bribe—handing money to an official to do his or her job, but to do it faster for you or to receive some sort of beneficial treatment. There are certain analytics that are focused on exactly those kind of anti-bribery and anti-corruption indicia, as they show up in transactional data.

Forensic Extract, Transform, Load (ETL) tool

JL: In our world, we sometimes spend weeks and weeks simply sourcing and curing data before we can interrogate it properly or thoroughly. We see so many different kinds of sourcing needs that we have built our own proprietary Extract, Transform, Load technologies to accommodate that. It's not because we think we're smarter than the packaged software providers that build these tools, it's just that those tools don't deal with the variety we see on such a regular basis.

This is especially evident in the context of data breach, system compromised work, or ransomware investigations in which we pull tools from individual endpoints in the network. For example, your laptop, which shows when an event logs off the traditional Windows laptop, firewall logs, proxy configuration, and third-party logs. If you have Amazon cloud services, for example, simply sourcing those things is challenging enough. Aggregating them in a common repository, unified under a single model that allows you to look for patterns that may originate on an endpoint—like a malware signature that then propagates throughout the network of your clients and shows up in other parts of that network—that's a very different kind of tool. The practical reality is there simply aren't packaged solutions out there that we can buy to solve these. So, we have taken our open architecture approach upstream, to the data sourcing and transformation side of things, precisely to address that. Because when your hair's on fire and you're dealing with an active data breach, you don't have the luxury of waiting for the data to be caught and aggregated.

Case #1: Fraudulent bank account activity

JL: Three or four years ago we were hired by a white-glove law firm to help a national bank satisfy what was initially a very gentle request, but one that became rather sinister over time. When the Department of Justice (DOJ) reached out to this bank, it clearly had some sort of whistleblower information about one of the bank's account holders: It was aware of a very discreet kind of fraud that was happening. The DOJ was essentially accusing the bank of failing to do its reporting on what are called suspicious activity reports (SARs), which are statutorily required of banks when transactions fall outside of certain expected parameters or might be—in the bank's judgment—suspicious enough to warrant putting up a flare for the regulators.

We were essentially charged with proving a negative, which is a challenge. So, we needed to look at different kinds of transactions, including wire transactions, check transfers, intercompany/inter-bank transfers, ACH payments, and credit card payments, in order to establish what the account holders were doing. We created sort of a financial dossier, pulling from different bank systems and third-party systems to establish a pattern of behavior. The bank was eager to demonstrate that it had not run afoul of its statutory

reporting requirements because consent orders are no fun, and I had no interest in being found in delinquency in that regard.

So, what we set out to do was simply aggregate a population where we could map, in a graphical way, the universe of these transactions. We spent months sourcing data from rather stubborn data sources like PDFs and other things that didn't lend themselves to ready aggregation. Then we began to correlate those activities

in a way that we could line up the chronologies, categorize the type of transactions, and then depict those in a very straightforward graphic.

The DOJ shared with us that what this account holder, who happened to be an attorney, was doing had to do with what's called an interest on lawyer trust account (IOLTA), which is a special kind of bank account where the lawyer holds a client's funds as a custodian, until there is a bill to offset those funds, and then pays that bill. If you think about the classic retainer check that you send to an attorney, he or she is not really allowed to touch it until there is a billable hour to draw down from that amount.

There was an awful lot of traditional checking account behavior in this IOLTA account, which was quite atypical. So, we spent as much analytical wherewithal as possible to isolate what those transactions

In investigative contexts, we often have to explain complex and nuanced facts to uninitiated and nontechnical audiences, so data visualization has become ever more important to our practice. If done properly with trustworthy data, you can distill complex thinking and analysis into a select few graphical depictions that can be very compelling.

consisted of and separate the signal of the illicit behavior within this account from the noise of the otherwise legitimate transactions that didn't have suspicious activity reports and weren't of any relevance or concern to the DOJ.

Through the tens of millions of transactions with tens of millions of dollars in any given year, we ultimately identified a very discrete pattern of behavior. There were outlier transactions we derived from keyword hits that were rather hidden in the general ebb and flow of these accounts.

We began to see certain patterns when we employed a traditional e-discovery approach and taking the memo (free text) files of these into an e-discovery platform. We pushed that back into the model and said, "If these things are true for certain transactions, for how many of them are they true?" The periodicity began to sort of hit a rhythm and it was precisely a biweekly rhythm that was more or less precisely the same dollar amount every other week—a little over a million dollars. What we discerned once we dug into those transactions—because it would have taken years to unpack all the dots that you see on this histogram—is that the IOLTA account was actually being used to pay payroll for one of the law firm's businesses.

IOLTA accounts are very, very specific custodial accounts; they are not allowed to be used for any other purpose than holding your clients' trusts, until there's an offsetting bill for that. Paying for your hobbies—and in fact some of these transactions involved paying his mistress—was not a legitimate use of the IOLTA account. What we were able to do in these analytics is isolate rather starkly the legitimate from the illegitimate traffic. And even more importantly, we found that all of the outliers were reported for suspicious activity by the bank.

Nearly seven months of forensic work showed that the bank met its statutory obligations, was not deficient in its reporting, and added to the DOJ prosecution of this individual, which was already underway. The bank did not incur a consent order or any further scrutiny or attention with regard to this matter. It was a victory for the analytics team to be able to show graphically that our

client had not only met its obligations, it had bolstered a corollary prosecution that the DOJ was beginning to ramp up. We turned from potential scapegoat and consent order victim to someone who demonstrated their compliance with the law and contributed to the prosecution of a self-evident fraudster with the information the bank was able to provide.

A lot of times we get lucky. Here, we spent three and a half months before we had this breakthrough, and the client was very antsy to either have us go away or solve their problem and have the DOJ go away. And we hadn't made much headway because these patterns were truly hidden from us. It wasn't until we introduced a rather atypical approach of bringing in unstructured data to do keyword analysis that we found this periodicity, this regular cadence of weird transactions that had been coded and categorized as something very different than "payment to my mistress" and "payment to my hobby company's payroll." That's not how they were written down. But when we back traced them to the destination accounts and researched who those account holders were, we realized that that was where the fraud was really centralized.

It wasn't until we took a step back and said, all right, what if we thought about this instead of like data geeks, what if we thought of this like eDiscovery geeks. And sometimes that's all it takes is to take the picture and turn it 10 degrees and say, you know, what if we're thinking about this wrong. I think that was the essence of this particular case, but it's emblematic of a lot of the work that we do.

MM: Oftentimes we go through the process of putting data through different filters and trying to isolate different variables in your data. Sometimes you can go through that process 20 times with no result like this, but you have to continuously put that filter on top of how you're looking at the data, whether it be different risk characteristics or other ways of looking at the data. If you're just looking at a scatterplot and everything on the scatterplot is gray, you're really not going to have anything pop. Sometimes that is quite literally just playing around with how I am showing this on a dashboard, what are some different ways I can think about it or

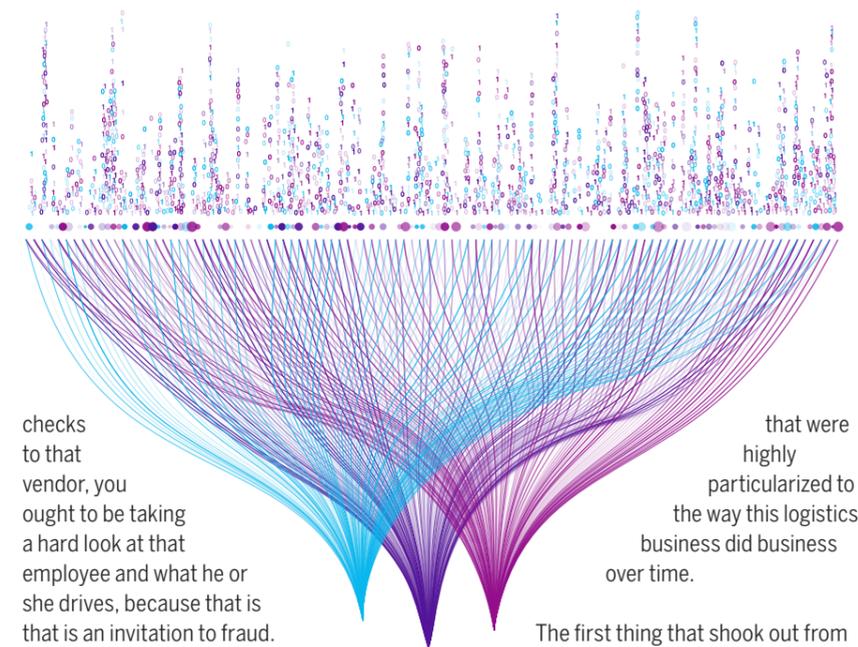
use the tools to look at different ways that I can represent it, then all of a sudden something pops out.

When we're talking about forensic projects in particular, we are hired by different parties for different purposes. There are instances where we are disclosed as experts, and our analysis and results will be reported and included as a part of legal proceedings. Other times, we're quite literally hired as consultants behind the scenes. I've worked on quite a few large multi-year litigation projects where at no time was any of our work disclosed. But throughout the course of the project, we help to pull data that may be shared with experts and relied on by experts as we prepare for depositions and trial.

Case # 2: Logistics company vendor fraud

JL: This next case began with a whistleblower complaint. The logistics company had identified payments—not a large number—to a vendor that they couldn't substantiate as real. They didn't understand how the vendor could have been created, how payments weren't checked, how the amounts in question didn't get scrutinized, or how the approvals seemed to be absent of internal controls: the vendor set up the payment thresholds, the approvals, the amounts, the work that was ostensibly delivered which was fraudulent and fake. They had one vendor reported.

They hired us because they realized that they didn't have the capacity to quantify their total use of their total population of vendors. They thought it was around 10,000, but it turned out to be over four times that amount. When we began to quantify the data, we began to unravel a vendor onboarding process that was anything but a process, and it had been going on for 12 or 13 years as a very manual effort. None of the managers that built the process worked there anymore. There were policies that were contradictory—different departments in different geographies had different approval thresholds, and some of them had no approval thresholds. Many of them had no segregation of duties, which is a really important concept in internal controls—the minute you give the same ability to one individual to set up a vendor and to approve



Our first job was to simply quantify the universe of vendors and to identify how many instances of fraud might be happening outside of the anecdotal singular whistleblower example that they found. That initial vendor had something like \$50,000 to \$60,000 that was quickly determined to be illegitimate, but it was a little too far in the rearview mirror chronologically to do anything about the payment. The destination account had been closed and the money was gone. They used what they knew about that vendor to feed us information, so when we applied the sort of anecdotal indicia about that vendor to the 40,000 vendors that we ultimately quantified, we didn't have any insights. We had this gray histogram with a bunch of uninteresting dots on it, and there were no obvious outliers.

We really had to rethink how we were going to stratify this population of 40,000 vendors. So, we came up with a tried-and-true approach that deals with risk scoring. We derived—based on their industry—their relative internal controls environment, and their culture, which is very informal and very sort of "Midwestern nice." Those things needed to be tailored into a risk model that allowed us to create a questionnaire of about 17 different criteria that we could apply at large to all 40,000 vendors. This criteria included things like payment histories, whether the same person who set up the vendor approved and granted them status, or had the vendor sent an invoice within the last 12 to 14 months. These were all things

that were highly particularized to the way this logistics business did business over time. The first thing that shook out from that stratification of questions was which vendors were manifestly low risk either because we hadn't dealt with them in over a decade or the amounts were so trivial it wasn't worth scrutinizing further. We struggled to find where it would be best to put the fulcrum of deeper scrutiny.

We did transactional analyses that helped us identify legitimate vendors through a series of iterative steps, but we were preoccupied with fraud, because that's what we were there to try and solve. As we zoned in on the vendors that got yeses to most or all of those 17 questions, we saw different patterns. That's a very traditional form of accounting analysis called "Benford's law," which basically says that in a distribution of any population of transactions there will be a discernible and expected pattern within the numeric values of that population.

Traditional fraud analytics apply Benford's law, which shows a curve representing transactions over time, while the outliers show up above or immediately below. When we did that for the entire population, we would have been analyzing tens of millions of transactions, without any context of risk. When we applied the risk scoring, that was one of the most effective ways to winnow this haystack to a manageable few, and we saw clear outliers in certain kinds of spend at certain points in time and a clear, anomalous pattern emerged. It was so anomalous in an already high-risk stratification of the population that we knew we were onto something. Other patterns were similar, but

not quite as pronounced, and one of the more innocuous looking ones was the whistleblower vendor, which we knew ought to shake out in this kind of analysis.

When we homed in on that vendor, we saw that all of its activity happened out of a particular state from a singular location. This is where you've got to love fraudsters—thank God they're not criminal masterminds, that's a Hollywood fiction—because it makes them easier to catch. This genius was the general manager of that store, and he was sending money to a brother with the same surname, who set up a business with his surname. So, the breadcrumbs were pretty straight lines back to him, and when we confronted him, we gained a whole dossier of a series of "reveals" as they're called. We had five or six sequential questions we asked him that were intended to lead him down the garden path, and barely got through the first one before he confessed.

This guy had been sending somewhere between \$60,000 to \$70,000 every month to his brother, for the better part of a year, to the tune of about \$400,000, which was pretty remarkable and brazen given that he was about a \$70,000-a-year employee. But he was in a position of remarkable trust—there was a very poor segregation of duties. We got the client comfortable that this was in fact isolated to this one bad actor. We found no evidence through email and other peripheral analysis that there were coconspirators or other colluders, or people who were doing their job negligently.

It became an object lesson not only in the way that we found it, but also all of the downstream controls that prove the negative: they show that this in fact isolated and helped make the client comfortable that this was not a rampant, systemic problem. We got there very quickly because this risk profile was nationwide—we did not create it with any regard to geography or with any regard to spend or the category of vendor. We had a really agnostic look that helped us confirm that our analysis would have caught the original whistleblower vendor, and this other misbehavior. So, this is a good example of how the data got us there, but we needed a filter to highlight something that would have otherwise stayed rather hidden in a normal Benford's distribution.

Digital Workplace Transformation: COVID-19 and the Rise of Remote Work

KELLEY ROUNDTABLE



February 17, 2021

Presented by:

Bill Slama, Senior Manager,
Technology Transformation
Grant Thornton

Many clients I work with viewed full-scale digital transformation as a concept that was years away from coming to fruition, and then COVID-19 came in like a wrecking ball.

I provide technology transformation services for clients in the healthcare industry, so I've witnessed first-hand how COVID-19 has transformed the way care is delivered to patients. Digital transformation is really an imperative now. You must have collaboration platforms (e.g., Teams, Zoom, WebEx, etc.) as the new way of doing business, sustaining operations, and building and maintaining relationships. Relationship building is probably the thing I most took for granted. Establishing relationships with a new client requires trust, and trust can be hard to build through a computer screen. COVID-19 truly has changed the way consulting firms deliver professional services and has impacted everyone—in any industry—period. The genie is out of the bottle. People know and understand that business can be done—and done successfully—through digital collaboration. Certainly, we are all extremely hopeful that the vaccination roll-out will see some return to “normalcy”, but I don't foresee things ever truly going back to how they used to be (i.e., in-person or nothing). But Twitter does have a policy from their COO in May 2020 that says, “If you don't want to come back in again, great.”

We are already seeing those companies who are not full adopters of digital transformation, virtual collaboration platforms, and flexible work arrangements are having a difficult time holding onto top talent. The collaboration tools that are now part of our daily lives are truly revolutionizing the way we work and interact with colleagues, friends, and family alike.

In 2018, an OWL Labs survey found that 82 percent of U.S. employees agreed that working remotely would make them feel more trusted at work. Although many businesses pushed back on that notion, as the pandemic continues, and the “work from home” weeks pass, many of those concerns were alleviated as things were getting done—in some cases more efficiently and effectively than before. Additionally, the employees' morale and productivity improved because not only could they complete their

day-to-day job duties from the comfort of their home, but they could spend more time with family, pick their kids up from school, or go for a run at lunch. They had the freedom and trust from their employer to get their work done and invest more time in their mental and physical health

Sixty-five percent of businesses say that a flexible workplace helps them reduce capital and operating expenditures. This allows companies to innovate and invest in other areas of the business while continuing to use collaboration tools to deliver value in new and interesting ways for clients.

An International Workplace Group study from 2019 found that 65 percent of workers believe employers that tailor the work environment to the work function of staff experience a more productive outcome. I couldn't agree more. So, things are changing. I know we all are getting tired of hearing this, but we are the midst of a “new normal.”

All businesses want top talent—top talent delivers, delivery makes businesses money, money grows the business, and everyone wins. Seventy percent of respondents in the International Workplace Group 2019 study, having a choice of work location is a key factor when they are evaluating work opportunities—this is pre-COVID. I don't have updated statistics, but I would assume that number has only increased. For 54 percent of the respondents, that flexibility is more important than working for “a name brand” company. By adopting flexible work arrangements, they feel their company is saying, “We trust you. Go spend time with family, your dog, spouse or partner, travel the world, work from a beach ... whatever it is, we don't mind as long as you get your work done and meet your business commitments and expectations.

This not only a technology thing, it's really a cultural shift that we're all experiencing together and figuring it out as we go.

The long game for businesses: What is digital transformation?

We define it as “the effective use of new and emerging technologies and methods to more efficiently operate your business, improve customer-employee engagement, and achieve

financial growth through the development of new products and services to drive competitive advantage.”

There are four different types of transformation: business processes, business model, domain, and cultural/organizational.

In terms of business processes, I'm sure you're all familiar with apps like the Domino's Pizza “Order Anywhere” app, where you can use your phone and order pizza with emojis.

This innovative approach to ordering pizza leverages data analytics, machine learning, and countless other technologies to make it easier for you to get dinner. Business process transformation doesn't have to be super complicated, sometimes it's just changing the way we do a very simple thing.

Domino's is one of my favorite examples.

Netflix is a good example of business model transformation. It began as a mail order DVD company. It wasn't too much more cutting edge than Blockbuster Video. As Netflix optimized their business, it invested in transforming the way that content and digital video is delivered to consumers. Not only did they acquire digital video assets from a myriad of existing production companies, but they also developed their own award-winning original content. They went through a business model transformation, as well as a cultural/organizational one.

I think our clients are savvy enough to know what needs to be done, especially now as a result of COVID-19, but not everybody can be Netflix or Domino's. It's a tough thing to do. It's not something you do overnight. It takes strategy, planning, investment, and buy-in from the top down. But there is significant opportunity to turn around the fortunes of your business if you can find a way to make it happen.

Digital transformation risks

There are a few things that I talk with clients about when discussing digital transformation risks. The first is the “quick

fix syndrome.” This is huge now because of COVID. With the global pandemic, very few people are in-person, so how are people going to communicate, share spreadsheets, and work collaboratively? I think a lot of companies have felt it and continue to feel it—they try to digitize overnight to find some way to fix this. I would caution against doing that. It's usually the same in life—sometimes the easiest fix is not the most sustainable long-term solution to a problem.

Staying siloed is another risk. To undertake an effort of this magnitude, it takes a village. I think a common misconception is, “I heard the word digital, and I heard the word transformation—that sounds like something my chief information officer or my chief technology officer will take care of, so I can wash my hands of it, not plan resources for it, not plan to invest any money in it.” Staying siloed will quickly get you into trouble.

Then there is trying to do too much too soon—companies want to move fast enough to keep up with their competitors, but it's important not to go too fast. Working incrementally, being agile is an iterative process—there are various ways to approach problems and put solutions together by working incrementally and experimenting constantly.

Working incrementally, being agile is an iterative process—there are various ways to approach problems and put solutions together by working incrementally and experimenting constantly.

Digital transformation benefits

We've hit on some of these benefits but let's put them into three big buckets, starting with customer experience. It improved in the examples of Domino's and Netflix. As consumers, we want the ability to do things faster and get that instant gratification—if I can't book a haircut on my phone, or check my medical record from my phone, then I'm not satisfied. An improved all-around customer experience is important.

If you are the business, an increase in employee productivity is key. Many companies have manual inefficiencies that could benefit from some type of automation. If we can reduce some of the time spent on manual tasks and restructure

it to more value-added things for the company, that generates revenue for the business and is a good thing all around. It helps define the roles and responsibilities, and it improves engagement. If you're giving companies shiny new tools and processes and more efficient ways of doing things—if it makes someone else's life easier—they're going to buy into it.

If you've done things a certain way for a long time, it is critically important to make sure that employees are educated about what is happening and that they feel it's happening with them, not happening to them. When employees feel they are part of change, it improves engagement and job satisfaction.

Lastly, of course, the business reaps the benefits of this by increasing revenues, decreasing costs, and increasing profitability. It is also poised to discover new products and services and figure out what else can be pushed out into the market.

Digital transformation outcomes

Some of the expected outcomes of a digital transformation include operational efficiency, improved customer and employee engagement, and new technology and service offerings. GT helps clients through tech and IT strategy, agile as a way of working, and developing transformation management offices. In terms of the technologies, we're helping a lot of clients leverage IoT, especially in the healthcare space—focusing on how to leverage the data and information EMR and ERP systems to make data-driven decisions.

Keys to successful transformation

Organizationally, establishing a Transformation Management Office (TMO), allocating resources, and defining the roles and responsibilities are essential. In terms of leadership and culture, communication drives success—especially letting people know that change is coming, and they are collaborators, not an impediment to change. This helps get people excited about what is happening. All these building blocks are part of digital transformation—it is not just a technology specific thing. Collaboration, communication, culture—really making sure the organization is bought into the change is a big piece of a successful transformation.

Ask Me Anything About My Consulting Career: A Q&A with Students

O'NEILL ROUNDTABLE



March 5, 2021

Presented by:

Lauren Anderson,

Graduate of the O'Neill School

Public Sector Advisory Senior Associate at Grant Thornton

Lauren Anderson: I graduated with my Master of Public Affairs from the O'Neill school in 2019, with concentrations in public policy analysis and conflict management. I received my bachelor's in psychology and nonprofit management from the University of North Florida. I'm a born and bred Floridian. My parents and family still live there, and my fiancé and I are getting married there in a couple months.

I live in Washington, D.C., now, and I have worked with Grant Thornton for almost two years. I was recruited through IU and started in August of 2019.

I have been asked how I got involved in public policy. To me, public policy is so much more than just what is done on Capitol Hill every single day. For me, it started with those nitty-gritty questions about why certain populations of people do not get equal service. Why am I afforded the opportunity to get a good education through scholarships, while my peer is not? The beginning of my journey really stemmed from those questions. At the heart of it, I always felt like I was called to serve people and serve in a capacity to make sustainable change.

I also have a love of nonprofits, which I see as community based—you serve people one by one and raise money to see change happen live. I studied psychology because I love people and I wanted to understand them so I could serve them better. I had an opportunity to go and serve, in a camp capacity in Washington, D.C., where I lead a bunch of youth missions in the inner city. I helped them serve the homeless, low-income students, and the elderly. That made the policy questions start rolling again for me. I began to think that this might be more than just nonprofit work—there are bigger issues at hand that we need to face.

I started researching schools for my master's that had programs about policy, which brought me to Indiana. I started out in nonprofit management, but as I realized the logistics of nonprofits, and that to make the change that I wanted to create, I had to raise money, which I knew I really didn't want to do. With policy, I realized I could make sustainable change that would affect a huge population and be able to help the government spend our tax dollars wisely and effectively and efficiently.

In the second year of my graduate program, I got really interested in education policy. I was working at a state agency that had me do a side project on education, and I just fell in love with it. I have always believed that education is like a superpower—it's something that no one can take away from you. I believe if we invest in the youth, we're already better off. I didn't have a bunch of electives left because I was dedicated to nonprofit management, so I went to my dean and asked, "I am interested in education policy, but we don't really have anything, what can I do?" She suggested that I take doctoral classes in the School of Education and allowed me to drop what I was doing with nonprofit management to go and pursue doctoral classes in education policy. I did that before I graduated, and it led to a perfect melding into my work at GT. I use every single aspect of what I learned in my master's studies to serve the government in the best way possible.

Question: *What is a memory that you have from your time at IU? There are so many guests on the call that are currently on campus experiencing what you experienced. What's something that you still, today, take away from IU and you just hold with fondness and reverence?*

Lauren Anderson: One thing that I loved with the master's program is that they created a community of like-minded people; almost like a family. I felt like we went through the barracks of war at times and then came out stronger together. For me, the coursework was hard. It was always very difficult, always very demanding. Having those people along my side, doing the same stuff, was the best gift in the world.

But there are so many memories that I hold so fondly. At one point, on the third floor of O'Neil, in the room where all the master's students would study, there was a Senate hearing going on. People would come in and out of that room between classes and there was an iPad sitting on the long tables, just surrounded by people watching the Senate hearing. I thought "nowhere else in the world would people just congregate to watch a Senate hearing on an iPad so intently and passionately." It was really one of the best decisions I've ever made, to get my master's at IU.

Dennis Groth, Interim Dean for the Luddy School of Informatics: *The way your experience with the nonprofits shapes and informs the way you think about people's needs is interesting. Perhaps the people who are served by the nonprofits need them because of policies. The policies that exist create the environment that people find themselves in. So, you've swum upstream, as it were, you know, to address that need. I find it very nice, so congratulations.*

Lauren Anderson: Understanding the flow of policy is so important. Dennis is right, when you get to serve one-on-one, you get to hear someone's story. When I was working with people who were homeless, I would serve them lunch, and say, "Tell me your story." Then I would get to see them and interact with them and see the service of that policy. But when you're working at Grant Thornton and you're working with policy executives and you're trying to implement something, you see it from a very high level. And it is very important, but sometimes it's hard to see that one person that you're serving lunch. Having that rounded perspective helps you see the work that you're doing, but never lets you forget that policy is affecting this one person. It's not just a document, it's not just a bill—this is something to serve someone and help them pay rent. It's important to continue to see the person at the end of the policy journey.

Question: *During your time as an undergraduate or graduate student, did you work on any side projects on top of your academics? How did you find your passion and interests outside of school?*

Lauren Anderson: I was involved in Greek life, which I felt went hand in hand with philanthropy. I was able to volunteer and work with the community and discover that service aspect. I was also a resident assistant (RA) at my college for three years. I worked in upperclassman housing, and I saw my neighbors—what they needed, what they were going through, how I could serve them and provide them with support. I felt like it just supported a mission of serving people, meeting them where they are, and seeing us as equals. Another important perspective on policy is seeing yourself as the person who you're serving. I've always loved to travel and I did a lot of internships throughout my undergrad years. My first summer I went to

D.C. and worked with a youth mission camp. In the summer between my junior and my senior year, I went back to D.C. and worked with a nonprofit that revitalized low-income educational spaces.

I was able to support them as an intern, and later as a project manager, where we would redo schools all over the nation. That was one thing that I did as an undergrad that I didn't necessarily have the liberty or time to do when I was in grad school. I went straight from undergrad to grad school, and a lot of my colleagues did not take that track. Both are great options.

Question: *What led you to conclude that consulting was your path, and that Grant Thornton was where you would best be served in your career endeavors?*

Lauren Anderson: Up until I interviewed with Grant Thornton, I had no idea what consulting was. It's nebulous—it's so confusing when you're not in it. One beautiful thing that IU does is that it has so many partnerships and alumni and so many activities going on all the time that I just went to all of them. I would dress business casual for class and then just see what's going on the rest of the day. That's kind of how I landed on Grant Thornton. They were visiting and had a bunch of alumni there. I was trying to figure out what consulting was, and I kind of had an idea of what they did, but I had no idea how it fit into that space.

When I went to Grant Thornton the thing that really interested me was that I didn't have to choose what I wanted to do. I could work in government, or I could work in policy. I could do things with nonprofits or I could do things with higher education. I could use things that I learned in program management or I can still figure it out. That's what really drew me to it, because I didn't want to pigeonhole myself just yet. At the time I was hired, I was interested in housing and education, and then, Department of State—so just stay tuned for the next one. I was able to really pursue all those avenues under the umbrella of serving people, helping support the government, and just generally making progress toward my goal of serving others.

Question: *What courses and skills in your MPA program helped prepare you for a*

consulting career? What do you think was most useful and appropriate to make that transition to a consulting career?

Lauren Anderson: The whole program sets you up for success at GT. But I think my capstone classes were incredibly helpful because you're working in a team environment, helping support the mission in a project for an outside client. So, capstone helped me move from being a student into consulting life. Start thinking about what kind of missions you'd want to support in your capstone as soon as you can, because you can choose from a plethora of different projects. I had one nonprofit management class that taught me how to write a good memo, and that's been valuable.

Question: *I'm a second year MPA student at O'Neill right now, with a policy analysis concentration. Have you found yourself using the quantitative skills that they pound into us at O'Neill in your role at Grant Thornton?*

Lauren Anderson: Sometimes I think I have used the perspective of the quantitative analysis more than the actual skills of the quantitative analysis, but it's useful to have them. I use Excel in my day-to-day life more than I ever thought possible. I think those skills are highly useful in consulting. No matter what project you're on, having an Excel background is something that will win you brownie points.

Question: *Do you feel that it's becoming normal in the consulting industry to have a master's degree, or is it required for professional certifications?*

Lauren Anderson: I think about this a lot because my fiancé is a consultant at a different consulting firm and he does not have a master's and so it's something that we've talked about a lot: Should he pursue it or not? What's the value of a master's program? At Grant Thornton, I have many colleagues that do not have master's degrees. They come in with an undergraduate degree and they do excellent work, they have done incredible things on their projects with their clients and they do incredible things at the firm. If you believe that your interests and passions deserve more exploration, that can be a good reason to decide to pursue a master's program.

Choosing to get your master's is deeply personal. It takes every single ounce of effort on your part. If it's something that you're not certain about yet, sit still on it, because it is a huge decision.

My consulting stereotypes are different than everybody else's but I think it's relevant to say that there are stereotypes of consulting out there. I thought I would never be qualified to be a part of consulting—that it is for the highly elite, which is false. I'm proud to be around the people I work with. They are all extremely smart and capable, but also real and down-to-earth; they'll do anything to help you with your career. Does anyone else have any like stereotypes that they want me to poke holes in?

Question: *You're always on the road, so you can't have a family, right?*

Lauren Anderson: I think the one thing about public sector consulting is that often, you are working with the government. When you're based in Washington, D.C., you don't have to travel all that often. There are instances where you will travel—I have a client with a bunch of site locations in different parts of the nation that I might need to visit once a year, so it would have been more of a fun work trip than a daunting, "I'm never home to have a family life."

For me at least, there was one stereotype of consulting that kind of burned into my memory, and this was because of a professor using consulting firms as an example in a class and saying that we would "sell our souls" if we sign with one. You can work for a corporate firm and still "lead for the greater good."

Question: *I hope that you can put this to rest for me, but I've heard it's hard to succeed as a woman in the consulting industry. Is that true?*

Lauren Anderson: I think that at Grant Thornton, I have been provided with ample opportunities to succeed. I've had opportunities in the firm to lead certain initiatives and help on winning work. I feel like Grant Thornton is constantly trying to break down barriers of diversity, equity, and inclusion. They just launched a mentorship program for women in the advisory public sector.

Question: *What I was told early on when I was an undergraduate student is that most people don't choose to pursue a career in consulting, that it's just a bridge to another position in an executive position in large companies.*

Lauren Anderson: I think that could be said for any career out of undergrad. But I have seen a lot of people who have had careers at Grant Thornton for 18–20 years, who I guess you can call "lifers" in the consulting industry, that have really perfected their skills in serving the government in different capacities other than being a federal employee.

Question: *I always wanted to know what the typical day looks like in the life of a consultant. And what's the typical sort of lifecycle engagement for a client—are you on site with the client most of the time, or are you at home? Is it a six-month engagement or longer?*

Lauren Anderson: Every single person's day looks different. But for me, I work on one single engagement, and I work on that 40-ish hours a week. I have a dedicated computer for that, and I have a computer for my GT stuff, and so most of the time we'll have them both open at the same time, and I'll pivot from one to the other. From like nine to five, I'll have meetings on my client computer and work on that most of the time, but then I'll pivot to Grant Thornton when there are proposal calls, which are what we do to win work opportunities.

Sometimes we will have business resource group (BRG) calls to listen in on; there was a recent one on anti-Asian violence. I also take training courses when I have time. I'm very task oriented and I write everything down, so I do a lot of checking things off the lists I make, and that looks different every single day.

Public sector clients are much longer-term than they are in the commercial sector, where there is a traditional six-month timeframe. With government, you'll usually get a base year, and then you can go up for option years. On my project we did one full year of our work, and then the contract was up for negotiation and they wanted to work with us again, so they renewed for an option year more than once. When a contract is up,

they'll either resubmit it for bid, where people can go after it, or they may have that project for 10 years. One of our longest running clients is Customs and Border Protection and the Department of Homeland Security. It can be very long term.

Question: *You mentioned BRG groups—business resource groups. Could you talk about those a little bit more?*

Lauren Anderson: I compare them to clubs in college. You can be a part of a BRG, or an ally to a BRG. So, for example, I am a part of the African American BRG but I don't identify as African American, so I'm an ally. I can still be a part of that journey. I listen and learn from them—they've been full of resources and knowledge throughout this past year about how we can be better allies throughout this time.

Question: *One thing that I've heard from students is this notion that you are going to lose yourself when you join a company and that there is no encouragement to retain any personal development, it's all about professional development. Can you speak to that?*

Lauren Anderson: One of the things that I've learned in growing up and getting out of college and graduating is that you hold the power to not lose yourself, and you can do several things to help support both your personal and professional growth. Every day, I try and get outside for a walk. That helps me get fresh air and clear my mind. One benefit that I've noticed professionally is that I come back less hostile toward my schedule, and more emotionally available to the people that I'm working with. I'm able to better support them when I come in with a better mind space.

I think finding those balances is almost like a perspective game. When you cook dinner for yourself or work out or whatever you need personally, it's not going to hurt your professional growth. If anything, it will set you up for more success and more longevity, because burnout is real. And you can prevent burnout by paying attention to your mental health and physical health, and just supporting those needs that you inherently have outside of the space of working or being a student.

LUDDY ROUNDTABLE



March 17, 2021

Presented by:

Chris Stephenson, Managing Principal Product Innovation, Grant Thornton

Product Innovation and Management in Consulting

I lead product innovation here at Grant Thornton. I've been doing product management roles for over 20 years, at a lot of the big tech companies. I started just as the Internet was getting popular and worked on a lot of the collaboration suites. In 2008 I was part of the very small team at a Fortune 50 technology company that worked on something called "technical computing" at the time, which became cloud computing, which became cloud wars. It was a 12-person team and they had a \$5 million revenue target that year—now they do that just about every second.

I've had a lot of opportunity to build products over the years. I'm also a consultant by nature. When I came to Grant Thornton, I started my time here building out the financial management practice and working on innovating finance organizations and doing transformations. I began leading product innovation about a year ago.

I get a lot of questions about what a product manager really does. One area of product management that is important is customer feedback. I thought it'd be fun to showcase a product we're working on—one we kind of fell into by accident—just to show you how the evolution happens.

Another question I get a lot is how to become a product manager. If you meet a lot of product managers, they all tell you "I got there by mistake." I'll tell you how to make those mistakes and maybe some things you can study right now that'll give you a better chance of falling into this crazy world.

What does a product manager do?

There are a lot of different disciplines in the lifecycle of a company, like research and development, marketing, sales, and operations. The concept of a product flows through all these groups, but nobody lives with the product through the entire cycle. One of the more famous people that recognized this was Marissa Mayer in her early Google days. She realized that as Google was rolling all these products out, there was nobody that was really living and representing the product throughout the life cycle. Each product would change over time, from the point of

research and development to when the first operations team looked at it, to when it was marketed and sold.

The job of a product manager is to represent a product through the entire lifecycle. They interact with different parts of the organization. They work from the research and development and continue through the design, customer feedback, inside feedback, go-to market, improvements, and support. They become a proponent of making sure a product is successful through an ecosystem in which it could get distracted, change, and ultimately fall apart. What Marissa proved at Google, and what has been formalized since, is that a product manager increases the likelihood a product will be successful by 200 to 300 percent.

The most important message for a product manager is the word "go."

The most important message for a product manager is the word "go." When you're done with research—let's go. When you're done with your design or

it's close enough to get out into the market—let's go. When you want to get something to market (even though you always want to do 10 more things)—let's go. A product manager's job is to represent and own the product throughout every cycle, to work with every team, and to make sure that product keeps moving through that cycle on a continuous basis. It really is that simple.

There's a lot that's fun about product management. You get to see the result of your decisions; you get to see collaboration every step of the way and assess whether it's working or not. You get to test market and see results on a real-time basis. There are great stories about the products that become winners. But some of my favorite products are the ones that are losers.

I love the story about the Post-it Note. 3M was trying to build the strongest glue in the world, and they totally failed. And when they totally failed, they looked at this glue—probably the weakest glue in the world—and they said, "what can we do with this?" Then they created the Post-it Note. Imagine that product manager's year—from having one goal, one market, and one set of feedback, then seeing that this thing isn't going to

work, to pivoting and finding something that is in almost every office. I have some sitting right next to me. That is what the life of a product manager is. If it had been left to research and development, sales, or marketing, that glue would have been dropped early. It took a product manager—someone that remained a proponent of that product—to take it all the way through.

So, what is the job of product innovation? Grant Thornton is a very large services company, but we must productize a lot of what we do. Our customers are expecting things to be done faster, more efficiently, and with higher quality. There's a lot of automation out there that allows us to take things that we've done as services for years and turn them into products. My goal is to make sure that is happening in all the different parts of Grant Thornton.

I have around 10 product managers that work for me full time and an entire development operations team, and we outsource contracts as well. There are three levels that we're currently thinking about. The first level is internal. We are rebuilding a lot of our infrastructure to be able to use modern technology to shift from a service mindset to a product mindset. We're changing our data layer, our infrastructure layer, our platforms, and we're changing the apps. Secondly, we're trying to modernize our existing service delivery. The goal is to take 30–40 percent of repeatable transactions—repeatable things that we do as humans—and automate them. That allows us not only to be faster and more complete, but it also allows our employees to do higher-value activities so that clients receive that higher value all the time. We're moving up the value chain by building products to support some of the lower value activities. The third thing is bringing new products to market. We want to stay in the areas that were strong, but we are taking new products to market and trying to lead the market or fast follow when we see good ideas.

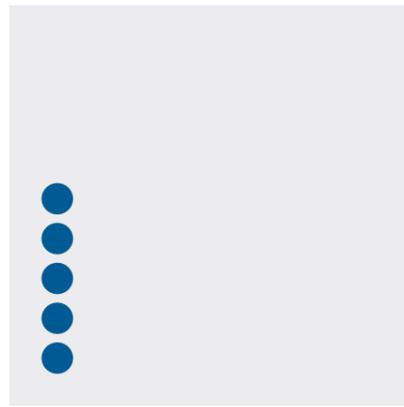
We don't have to have all the ideas ourselves. A good example of that is a product that we've recently launched around controls test automation and report accessibility. Previously, some poor associate on our team had to go and look at a spreadsheet of all the reports that had

been accessed at a company, see who accessed them, and then record whether it was the right person or the wrong person on a spreadsheet. They had to do this about 500 times every quarter—it was not fun for them. In the end we would tell our clients, "we tested .01 percent of your population, and you pass. Congratulations, here's the bill." It was a lose-lose-lose situation: Our associates weren't happy, we weren't happy, and our clients weren't happy.

So, we asked a long-time client if we could run controls tests with machine learning. We had years of test data behind us, so we pulled out an Azure Machine Learning bot and trained it—the bot ran years of records in about three and a half minutes. We tested it against that quarter's results and made a few tweaks, then we ripped a million records in two minutes and 27 seconds. The entire set of that month's reports were run in two minutes and 27 seconds. I'll never forget it. We found 57 false positives, and we found one positive in that set. And we were able to hunt every single one of those down in less time than we used to spend testing.

Every product has a magic moment, and in that case it was that we found a control risk. We found out that if somebody was granted access above their level to one report, they were granted access to all reports at that level and that was a big no-no. So, we found an error, and we realized we were onto something. Today, we are launching controls test automation and we think we will change the entire industry with this. We can do 100% coverage testing on anything that's automatable. We're rolling it out to our clients, and for the first time we can move downstream, to small companies, that could never afford our people to come in to do all that testing. But they can afford the subscription, so we can increase our market size. It's higher quality work, and it all came from one idea that inspired us to ask, "Can we do this?" That's the kind of thing we're trying to do in our industry.

The team now must write a paper for the Association of International Certified Professional Accountants (AICPA) about flipping the testing module. And instead of reporting the percent of tests you must do, we now must determine what percentage of fails is still considered passing. So, we not

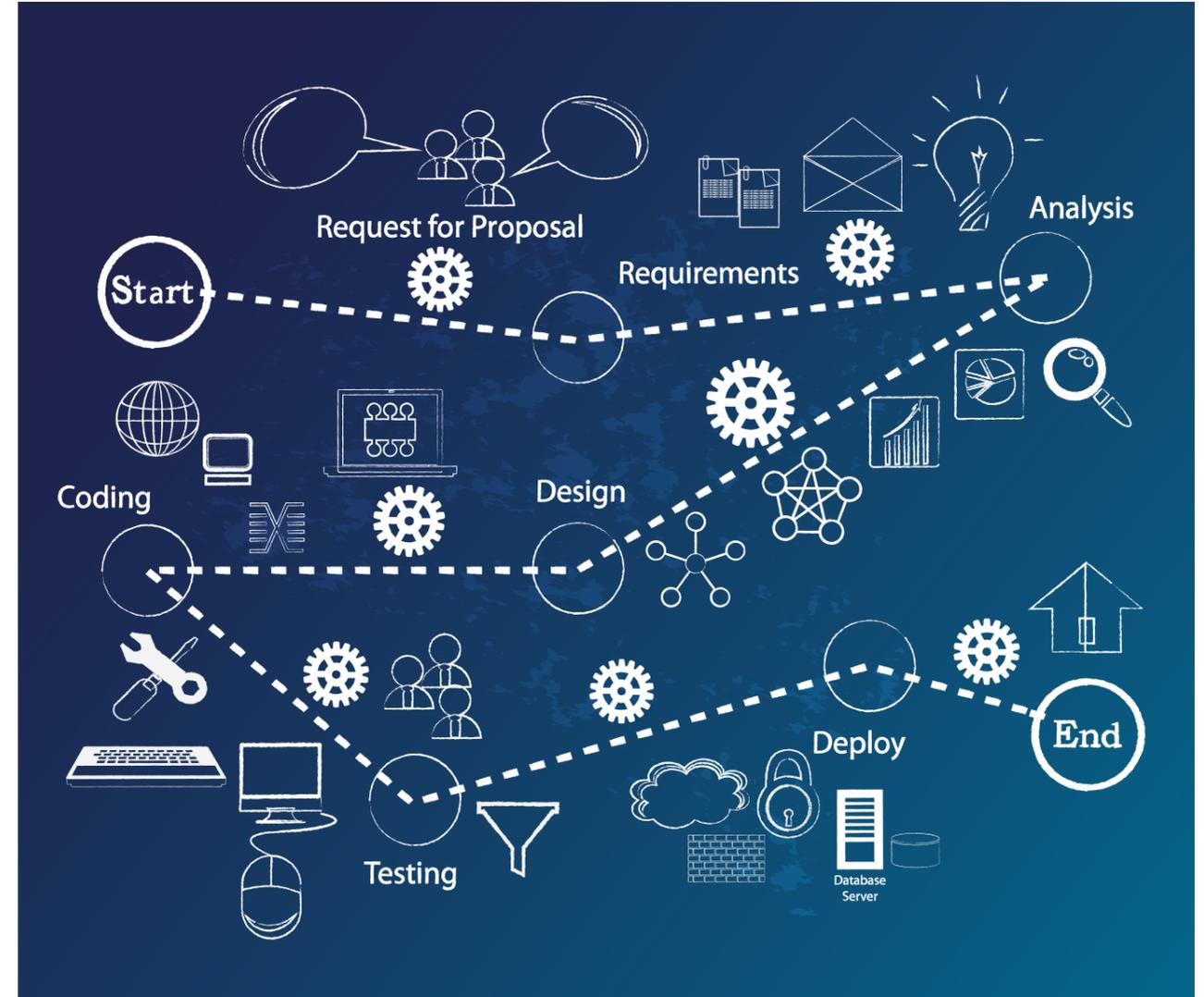


only have to rethink the product and the solution, but we also must rethink the entire industry and how to regulate this. That is when products get kind of fun. My job is to look for opportunities like that and, when we find them, to give the teams that came up with them the encouragement, focus, and resources they need to do awesome things like that every day.

The Starbucks test

If you read any book, it says get customer feedback and internal feedback. I always like the startup Starbucks test. If you have an idea, start by writing it down. If it still makes sense on paper, read it every day for a week. If it still makes sense then, do the Starbucks test: Go to Starbucks, stand in line, buy someone a coffee, pitch your idea, and see what they think. If it keeps going beyond that, it's probably time to start thinking about building. As you build—whether you're doing that early research and development, your first round of funding, or building your first prototype of the product—getting feedback along the way is one of the most important things you can do.

One of the biggest risks that comes with feedback is there are five bad groups of actors that can distract you from getting complete feedback. You must be careful—I don't mean that you don't listen to them but do recognize when you're talking to one of these actors. The first actor is what I call the "naysayer." The naysayer is never going to like your product. There are people that are not going to like your product. I do not like liver, I just don't like it, and even if the liver lobby put sugar in it, I would still not like it. Every product has naysayers, and I have the arrogance at times to want to say, "Naysayer,



I'm going to prove you wrong. I'm going to make you like this." But the amount of time, resources, and energy dollars that go towards trying to convince naysayers to come along for the ride is just not worth it—take the feedback and move on.

On the total opposite side of the spectrum is the superfan. You will have people that love your product, no matter what you do with it. I think about Reed Hoffman talking about LinkedIn when I think of the superfan: Five percent of the population of LinkedIn loves it so much they want to use it for everything. Hoffman always says that if he had listened to that part of the population, he never would have scaled. He would have built features to the superfan instead of the regular fan. That audience will tell you things are awesome, but they're so focused on your product that you won't get the feedback on what else you need to do to scale or get to full adoption.

The third is what I call the reactionary. I always blame the sales team on this. One of our salespeople will come back from a call and say, "Chris, we need this product right away. I just talked to the client—our competitor has this, and, if we had this, I would have won this project." They are reacting to a moment in time. Now, if you hear the same reaction repeatedly over time, that can be helpful. But if you react to everything that happens in the market, you will never launch a product. There are competitors in anything you do, and when you have an idea, five other people will have that idea, even if you think it's fresh. If you watch them and react only to what they're doing, you will forget your own business and product plans. So, reactionary feedback is great at a long-term level—if you hear the same reactions over time you do need to think about it, but overreacting to those reactionary feedback points can be very dangerous.

The fourth is what I call the disconnected dreamer. We all know a disconnected dreamer that's always thinking about five years in the future: Why bother building anything? I'm just going to invent a time machine, go back in time, and make smart investments. The disconnected dreamer is awesome when thinking about the long-term vision of your product. You will often get ideas and insights that you never thought about before. It can also lead you to put a lot of money into something that's not ready yet. A disconnected dreamer is great for thinking long term, but sometimes you must bring it back to the real time.

And then finally is the bully or the boss—the loudest voice in the room, which often wins. There are a lot of ideation tools out there where the loudest voice seems to always win. We do a session that we call a "quickstart"—a day-and-a-half session where we have a business problem framed,

but no idea where to go with it yet. It's a way to rapidly get to a prototype. We talk to the bosses in the room, and we say, "we need two things from you: We need you to come in for the first 30 minutes and say how important this is and then we need you to go away." When we're ideating and truly trying to get a problem solved, we know that we're going to get feedback from the loudest voices. We need to get them quieted down and out of the room so that all the other voices show up.

The naysayers, the superfans, the reactionary, the disconnected dreamers, and the bully bosses are all feedback points that can add assets. But they're also your five riskiest groups. So, what's in the middle? There are a lot of quiet voices in the middle that get missed by a lot of product managers and development teams. As a product manager, you need to take those five groups with a grain of salt, realize where they're strong or weak. But a lot of times the decisions from those louder groups are answered within the middle.

As I jumped into this role of running a portfolio, I recognized that we had all those players at Grant Thornton. I also realized that, in an 8,000-person organization where we're trying to bring innovation to clients every day, we must give everybody a voice. That's how a product came out that we call Alex. Alex is named after Alexander Grant, our founder. Our storyline is that Alex is his great, great granddaughter, who works at the firm now. She believes in the same values and the same services but has a different way of doing things. Alex really wanted to democratize ideation.

The goal of Alex was to give every single person in the firm a voice, by asking each person "What is your business problem?" Then we asked them to "Write me a scenario." From that point, and from that submission, we route all those ideas to our different delivery centers. Those delivery centers may be a no-touch situation where our own citizen developers work on something. Or it may be our "factories," where we do a lot of our automation offshore in a repeatable format. It might be what we call a "unicorn project"—a special six-week project where we're testing a

hypothesis. Or it can be a big build, which usually costs a lot of money and takes a lot more time.

We did not discriminate upfront like a lot of ideation software does. We considered every idea and routed it to the right place. Sometimes ideas got parked and then combined. But we found that suddenly we gave a voice to the entire firm, and we started hearing a very different message about where the investments would go. If you asked me where we needed to put our money and our major investments a year ago versus today, it's a very different answer. We've had over 900 submissions this year and have addressed more than half of them. Only five percent of those submissions go to big builds. Most of them go to quick wins, which have resulted in over 200,000 hours saved and over \$12 million in revenue generated. We've created an environment with this tool that generates micro wins, which create macro momentum featuring bolder and bigger ideas. I believe we're surfacing that group of feedback that does not get heard enough through this concept.

At a product level, it's a discipline we needed to have. At a portfolio level, we are onto something. This is just the first step. As we continue to think about Alex, we're not thinking just about technology business problems, we're about to stand up our risk center of excellence, which allows any of our risk practices to submit new templates, ideas, or processes. I believe we have built a platform that allows business problems to be connected to the people that can solve them as fast as humanly possible.

We're starting to think about chatbot technology on front instead of surveys, we're using machine learning routing in the middle to get things there faster, and we're putting automation on the back end of many submissions so things can get solved in the moment. All of this was created because we had a small problem at the start, and we thought about how big we could take it.

The Hollywood movie idea that that you wake up one day, have a vision, and then it becomes a product where everything works—I've never seen that happen. The

stories that I'm telling today are honestly how most products are built. The product manager job is important because if you do not have an advocate living the product and thinking about the product, the pitfalls you can fall through, or places where you can be stopped short are substantial.

I worked on the launch of a cloud provider tool and it was built in a conference room in 35 minutes. Credit cards weren't usable yet—it was a free non-credit card trial of the tool. We thought it was going to last six months, and we'd get maybe 5,000 users on it. Four and a half years later, we were getting 50,000 new users each month. And the story didn't end there. The product manager and product owner I worked with were exceptional. As they saw the potential, they added more to it, and they listened to more groups. By year three, it was a major acquisition strategy of customers.

Three trends on the rise

You'll probably recognize all three of these, but I think they are all still immature. The first trend is AI platform mindset, which is clearly showing that it's a scalable business model. Uber and Lyft are a platform. The concept of platforms is you have a buyer and a seller and a transaction in the middle. Instead of trying to just get buyers or sellers, you own that transaction, you make it better for both sides, and then you use the network effect to grow. The number of rooms available through Airbnb became ten times the size of Hilton in five years, because it focused on the transaction in the middle.

Drizzly was just sold for \$1.1 billion to Uber. Drizzly is an alcohol delivery service but it is not actually a service—it is a software that connected package stores to those that wanted to buy alcohol. It gave another sales channel to all these package stores. The one in my neighborhood hand-delivers. There are others that connected into Uber to use their driver service. They sold for \$1.1 billion, and they never actually did anything except connect buyers and sellers. This concept of platforms is continuing to evolve and emerge. If you really want to look at a product a new way, look at an area where a platform has not been built yet, and think about how to focus on the transaction to

make it better. I am convinced that this is a delivery model—a software and service model—that does not have a top barrier of entry, can always be improved, and has explosive growth potential because the network builds on itself once you've established the platform in the middle.

The second trend that I'm seeing is the no or low code trend. I grew up on C++ coding, which was hard stuff. It's object-oriented coding—I don't recommend it. But now, the low and no touch coding can take things and drag and drop them. The Chatbot technology that we currently use is easier than building a PowerPoint presentation 20 years ago. You simply drag and drop different pieces and add a little workflow. The idea that everyday users can code things is an amazing concept. Our current vision at Grant Thornton is to get 9,000 people using emerging technology every day. No code is that solution. Instead of having to use Alex every day to submit a problem, what if we could train the community how to do 20 percent of what they submit so they could just fix it on the fly? What if your accounting department sees an automation that was required in the past, and now, suddenly they can just make the code change on the fly? This concept has a lot of teeth, but there is a huge behavioral shift that needs to happen. One thing that we've thought hard about is focusing less on senior people in our organization that are set in their ways and more on our developer community in its first five years of career. I believe that one way to get into product management is to learn low or no code and work your way up into some of the bigger builds. I once said I think technology should be at least acceptable as a foreign language; I think at least one type of code should become a mandate at most universities. I think it's getting to be that much of an everyday occurrence that you're going to run into technology and these low and no codes on a regular basis.

The final trend, which has been around for a while, but I think it's changing, is data. I get pitches from a lot of suppliers about data. It is still the number one subject of emails I

get. Everyone has data for this, data for that. Nobody thinks companies collect data very well on their own, and maybe they're right.

The phrase "big data" has been very popular for a long time, but I think the next trend is going to be small data. I think big data is too much for systems, too much for organizations. I think the focus is not have less data, but rather to really focus on what data is important to your organization. Then, you either buy, build, or manage that data very tightly. If you knew that three pieces of data could drive your difference in a win and a loss, you would scrub that data daily.

The concept of big data has overwhelmed us with the challenge of what we have to do with it when we get it. I see math becoming cool again, and the idea of vectoring becoming cool again, to truly figure out what's important. The concept of neural networks is so cool—machines can actually help you figure that out. We're looking at our win-loss data over the last decade, and we're asking a machine learning algorithm to teach us what connections it is seeing that we're not. We're not going to drop all the other data, but we're exploring the reality that there might be three or four data points that a bot will tell us is the differentiator. So, we're going to get a lot clearer on the quality of that data and how to use that in our decision-making process. We're taking a big data mindset and trying to narrow it to focus on a small data set.

Data management programs inside companies are not worth the money they cost anymore. I think outsourcing of data is going to become a much bigger trend in the next ten years. We think of compliance as a service is very interesting and that's something we're focused on, but I think the big firms are going to focus on data as a service. The value of data entering your systems is that it can zing around and do really bad things. If you have data as a service and it comes in clean, it stays clean and it zings around clean. I think we're going to see a lot of organizations slowing down how much data they try to control in house.

How does one become a product manager?

I really do think most product managers get here by mistake. They start out focusing on tech, then get into product. But there are a few things that we look for in product. One skill that is super important is collaboration—the ability to frame problems, open up ideas, prioritize those ideas—but also the ability to present on the fly. All those funny workshops you do and presentations that you do in class, I promise you they pay off. A product manager is almost always trying to convince someone to do something they don't want to do. It's a daily occurrence, it's an hourly occurrence, and it requires that presentation skill.

The second is data. A lot of decisions are made with qualitative feedback, backed by data. Statistics are very important—knowing your percentages and what level of certainty you have on decisions. Knowing how to model is also important. When you're building a new product, every ROI is different. There's no standard template that you fill out. Financial analysis is important. And then finally, design skills—there's a lot more science to it than you think. I always say, if you're going to be a good designer you've got to learn business cases, because every single design is a business case in the past that succeeded or failed, or a combo thereof. I love business cases because I can go back and read up on them and start to design a solution based on what worked and what didn't work. But the discipline of thinking about design that way must be practiced.

There are a couple of traits a product manager should have. They need to be objective. I'm very passionate about the products we're building, I really believe in them, but I've also had to put down a lot of wounded products. There are times we must cut bait or change. You must focus on your product but you also must make the right high-equity decisions. That can go against your instincts or what you want to do. Fearlessness is also a trait in product managers. There's nothing scarier than putting a product out into the world. We look for a fearless mindset in the product managers we hire because there are risks that must be taken. And I think that's part of the fun.

Understanding Cybersecurity and the Impact to Operations

KELLEY CASE
COMPETITION



April 9, 2021

Presented by:

Chris Ballister, Director,
Cybersecurity, Grant Thornton

Ballister's work focuses on the relationship of information security, IT governance, privacy, and risk management supporting the C suite throughout the public sector. Ballister has served in government at the senior executive level as both a deputy and chief information officer in the U.S. House, the White House, and the Office of the Inspector General of Health and Human Services. He has been a CEO and president in industry, building small companies supporting intelligence and cyber threat protection missions for the government. Chris is also a United States Naval Academy graduate with 24 years of service, and a retired Navy captain. He has a master's degree from George Washington University's Department of Engineering and Information Management.

Clarifying security terms

Before the Internet, the way things were run, everything was information technology (IT), and IT architecture was a big deal because it described how all the IT was put together. Once the Internet started to take root, it was a combination of IT plus the Internet that created the term "cyber"—cyber-this cyber-that, cyberspace. As the use of "cyber" has blossomed, I've found that the word tends to get used as a substitute for information security. It's a little less accurate, but it has drawn attention to the importance of protecting information in the heavily IT and Internet world that we have now.

It's important to be clear about what the different terms mean. IT security focuses specifically on the technology—when you hear that term, it's about the technology and the various security tools associated with protecting the technology. It is not to be confused with the wider scope of information security, which is where you'll see terms like chief information officer (CIO), which goes beyond the technology. A chief information security officer (CISO) is concerned with protecting not only IT equipment, but information that may be in paper format as well. So, information security has a broader role than just the IT piece, and is the foundation for a lot of government standards, such as National Institute of Standards and Technology (NIST) and the Federal Information Security Modernization Act (FISMA).

Information assurance is a little broader than information security, and it includes a lot of people and process stuff—like rules that govern how you may talk about sensitive stuff in a bar with your friends—that goes beyond just the digital or paper.

So, what has cybersecurity evolved into? It's really about the portion of the IT that is critical to business processes. While it includes a little bit of everything, it's focused in the areas that can make or break an organization in succeeding in its mission.

Holistic information security program

Security compliance has become a big deal—a lot of organizations have to comply with some sort of security compliance rules. For example, any company out there that processes credit cards has to follow the payment card industry (PCI) security standard. Anyone that's processing protected

health care information has to follow the HIPAA high tech security rule. There are also compliance items that are not just government agencies—commercial companies run into them when they handle certain types of data or interact with the government.

Cybersecurity budgets encompass compliance, efficiency, and security protection. There are points in time where they may let the compliance go to be effective. When they do that, they may end up getting an audit, and when the inspector general or auditor tears the company/agency apart, they shift their focus to compliance and forego areas of effective security that keep themselves off of the front page. The things they'd really like to do to protect themselves may fall off the table, until there's a breach and they end up on the front page. Then their focus shifts back the other way.

How do you resolve that? A lot of organizations are so busy that they don't have time to focus on it and it just continues to get worse and they spend all their time bailing the water out of the boat without thinking about how to plug some of those holes. But if you establish an information security program that focuses on doing the right things to protect yourself, but in a way that also gets you the security compliance credit, you're improving your security efficiency. That's a way to stay within your budget constraints, and essentially have your cake and eat it too.

As Grant Thornton has built its cybersecurity practice, we've worked on helping our clients figure out how can they continue to protect the organizations with the budget reductions that seem to happen all the time.

In 2009, the headlines put the Transportation Security Administration (TSA) in the spotlight. They billed it as a massive security breach. What really happened here? It turns out that TSA took their instructions on how to do inspections, and instead of putting it in their intranet—internal TSA—they accidentally placed it on the Internet side, so that everyone could see it, including all the terrorists. This was really an information governance problem, or a content management problem, but it was billed as a security breach, and the CISO took a lot of heat for it. There's a direct relationship between IT governance and

information security. If you don't have good IT governance and your processes are all inconsistent, or you don't have good standards, it's very difficult to secure that kind of environment.

When we work with our clients on how to enhance their security program, the idea is that while you can do information security, you need to do it with respect to these other key areas. There are things you can fix in your IT governance that make life a lot easier when trying to secure the environment. It's the same thing for risk management, which helps you to focus on the IT that's in direct support of the things that matter most to business success. This is especially true when businesses rely on financial management, and all of the sensitive data that's associated with finances. When they go through a risk management process, they find out that area, along with the IT that supports it, is some of the "crown jewel" stuff that they are going to want to protect.

What is SecDevOps?

A lot of technical folks love to get involved with IT for its own sake because it has cool toys, but that costs money. How can you focus your IT pursuits on the things that really matter to operations, to improving and enhancing your business operations? The alignment between development and operations is critical. Over the last decade, people have realized that when security is just an add-on or an afterthought, you can develop something cool then realize it has all kinds of holes that you can end up frantically trying to plug up. By focusing on things like risk management and IT governance, you figure out how to incorporate security along the way so that you can have integrated security with your technology in support of your operations. Governance boards look for the relationship among these three areas as they approve projects so when they spend money on it, and it goes through the systems development lifecycle, they are actually making important enhancements to the way the business operates with integrated security. This is referred to as the SecDevOps. Both federal agencies and commercial businesses are finally starting to recognize that this is a worthwhile, valuable concept. Integrated security! Imagine that.

Evolution of NIST to CMMC: A basis for best practices

You may have heard about NIST, or about the government following the Federal Information Security Management Act (later updated to Modernization Act), from 2002 to 2014. It gave the Office of Management and Budget (OMB) and the Department of Homeland Security a little more oversight in the process. This has been slowly evolving to serve state, local, and commercial entities. It is a very well adopted standard used by a lot of folks. The initial use of NIST came from FISMA—there's not a lot to FISMA, it's Title III of the eGovernment Act and it directs federal agencies to do what NIST says. It includes a lot of controls and enhancements that entities need to follow (at the moderate level, you would need to follow 261 of these controls and enhancements). We reached a point where NIST started to develop a publication—The 171—to help commercial vendors and organizations figure out how to protect their corporate networks. That way, when they take on data from their clients, there's at least some assured protection of that client data, focused that what's called Controlled Unclassified Information (CUI). One of the first adopters of The 171 was the Department of Defense (DOD).

When the DOD adopted the standard, the Federal Acquisition Regulations—which guide all the federal agencies—were thinking about it. Then the DOD upped the game by layering a maturity model on top of The 171. They've done it in a way that's very stringent.

So, when we went to The 171 from the basic NIST documents for federal agencies, the federal agencies all had a policy and procedures requirement. They initially dropped that a little in The 171 because they expected commercial companies to have different versions, but they've brought it back. Now there's a whole other area of requirements in the CMMC process that involves making sure that policies and procedures align to all the required areas of protection. Getting policy straight from the beginning is a very important part of security protection.

Incident response

In the NIST documents I mentioned, there are lots of different families of security controls,

and they cover a lot of key areas. It's more than just IT—it's awareness and training, physical security, personnel security—security controls that live within 17 different families. Let's drill down into the incident response family. I sort of chuckle over this one anytime I come across an organization that boasts about their incident response plan. If they use it all the time, that's not good. A company should be preventing breaches so they don't have to use their incident response plan. That said, things will go wrong, and they do need to ensure that they know what to do when that happens.

Within the vast amount of NIST publications, there is usually a publication that focuses on a specific area to give you guidance. There's also what's called the Federal Information Processing Standards (FIPS), which also has a series of publications under the incident response header. NIST's computer security incident handling guide is a great source to go take a look at and see; it characterizes the kinds of things you should be thinking about for incident response.

As I mentioned, the real challenge is to avoid having to use your incident response plan. As you create your information security program, one of the key aspects of this is to do what's called continuous monitoring. You're supposed to have capabilities within your information security program, so that when you're actually monitoring things you're monitoring them with two main purposes in mind. First, you're monitoring to make sure that you don't fall out of compliance. That's important because there's a lot of basic compliance things, like knowing exactly what IT products or components are on your enterprise. Are they all up to speed with the latest patches? Do they have the correct security baselines configured in the software? Equally important is staying ahead of the threat—not being reactive.

As you get into your continuous monitoring program, you'll most always be in a defensive mode. There are very few organizations that have an offensive role in information security. There is a Computer Security Act which says that if you go into someone else's environment without permission, you can go to jail. So very few



20 PERCENT
of an information security regimen is technology-based—the remaining
80 PERCENT
is a mix of educating people, having processes and doing IT governance

organizations have an offensive mission. But in your defensive role in information security, you can either be in a reactive mode, where you're waiting for stuff to happen and you get to use that great incident response plan that you've created, or you could be a little bit more proactive, where you're not only staying up to speed in your compliance, but you're monitoring certain key areas for funny activity. Then if you see some funny activity, you analyze and figure things out and patch some holes before there's a breach.

If you have a breach, you get to do cleanup, which is often referred to as mitigation. But if you're staying ahead of the game and looking at the external threat data, you're using a security intelligence approach—which is a very structured process of monitoring things, analyzing them, and coming up with conclusions if they are a little bit out of the ordinary. It gives you the chance to remediate some detected vulnerabilities whether they are related to compliance or not. When you patch those holes before the breach happens, that's a proactive way of being in a defensive mode. You're sort of looking forward and staying ahead of the threats to avoid having to use your incident response plan.

In the NIST document identifies three key areas: containment, eradication, and recovery. It becomes very important during an incident to isolate what's been affected and if possible, isolate it in a way that allows the business to keep operating. That is sometimes a lot easier to say than to do. There are all kinds of NIST guidance documents and other best industry practices that guide you through creating your IT architecture in a way that's segmented, has different protections built in that make it a lot easier. Then when something bad happens, you can isolate and work on cleaning up that issue, while the rest of the company can continue operating with a very low risk of infecting any other areas.

That's a balancing act that does take money—there has to be an investment into the architecture. At the end of the day, it's a byproduct of your cost benefit analysis and whether you can afford to be stuck with a security breach that takes you down and keeps you from operating. There's also guidance in business impact analysis. These are all things that your C suite has to consider when your CEO is working with your COO, along with your CIO and your chief technology officer and your chief

information security officer. This is the balance that these folks have to discuss and figure out to move forward.

Most organizations have all the right pieces, but unfortunately they're in silos, and everybody is working hard to do a good job in their specific areas. When budget cuts happen, the first types of positions to go are often the horizontal positions that cut across all the silos. One of the biggest shortfalls I've seen out there is a horizontal systems/security engineering role that cuts across the IT organizational elements. For example, the network guys can draw you a great picture of the network, the database guys can draw a nice picture of the data architecture, the folks that have to take care of firewalls know where all the firewalls are... but what nobody seems to have is the consolidated picture. What really represents your information technology architecture is all of those layers put together. If you don't have that consolidated picture, it's very difficult to begin the discussion on how to overlay a security architecture on top of your IT architecture. While a lot of organizations realize they have a problem, they're at a loss when it comes to furthering the discussion about what to do about it. As soon as high costs are projected, they find a way to ignore it.

There are also a lot of companies out here that will advertise the silver bullet if you buy a certain security tool, but in reality, technology in an information security program is only about 20 percent of what you need to do. The other 80 percent is a mix of educating people, having processes, and doing IT governance. There are a lot of things that you need to clean up before you even get to the point of figuring out which security tools to buy and implement. The lack of horizontal roles in many organizations makes it hard for them to figure that out.

Thoughts on Artificial Intelligence for Rural Health, Wellness, and Resilience

LUDDY RESEARCH SPOTLIGHT



December 9, 2020

Presented by:

David Crandall, Associate Professor, Director of Graduate Studies, Luddy School of Informatics, Computing, and Engineering, Indiana University

IU was founded in 1820, so this is its 200th year. It's kind of interesting that there was no such thing as photography in 1820—the first photo that was ever taken was in 1826. For most of that history of photography, we've been able to take images, but the idea of having a computer be able to automatically understand an image is something that's fairly recent. Today we are able to take big, beautiful photos; there are cameras everywhere if we look around. Just recently, Artificial Intelligence (AI) technology and computer vision technology have been able to make impressive headlines become a reality—things like “Facebook's facial recognition is approaching ‘human-level performance,’” or, in the medical domain, AI is “better than humans at spotting lung cancer.”

This has been a really long time coming. People were thinking back around IU's 100th birthday, in May 1929, about computers or machines that would, someday, be able to “see.” Around IU's 140th birthday, the Navy had a press conference to say that they had solved AI and introduced a computer that they expected would be able to walk, talk, see, reproduce itself, and be conscious of its existence. That turned out to be a little bit premature.

In just the last few years, we've made substantial progress that is super exciting. Now we're exploring whether we can automatically detect animals and identify them amongst thousands of different precise scientific names for animal species. There are systems that can actually do this—maybe accurately only 60 percent of the time—but that's way better than I as an untrained person can do in terms of findings animal species' names. And we can identify and track objects in real time.

My lab has worked on a collaboration with Crane Naval Base, which is close to Bloomington, where we are using computer vision to look for really fine-grained markers of counterfeit computer parts. We've also done a lot of work in large-scale 3D reconstruction. This is yet another thing that I think is impressive that the field has been able to do in the last few years. We can now take tens of thousands of photos from a social media site like Flickr and run computer vision algorithms that

can stitch all of those images together to create a 3D reconstruction of what a certain place looks like. We've used the same technology to reconstruct the structure of the polar ice sheets, using radar to peer through the ice and see what the structure is below.

We've also been working on autonomous driving/autonomous vehicles—not only detecting all of the objects that are in the scene from the perspective of an autonomous vehicle, but trying to predict what's going to happen next: what is each person/actor in the street scene going to do next? This is important because it doesn't really do any good if we can detect that a pedestrian is right in front of us and it's too late to brake. We are trying to identify and predict what people are going to be doing a couple frames ahead of time so we can react. We work on trying to identify unsafe situations—things that are anomalous in the field of view of the of the camera that we don't usually see that could indicate that an accident is about to happen, so we can take evasive action.

There has also been a lot of recent work on the connection between images and language. These days, we have machine learning models that can actually learn to translate between images and text. You can feed in an image that the system has never seen before, and the machine can not only understand what is in that image, it can write you an English sentence that sounds like it was written by a person: “I am typing on my laptop computer. I'm shopping at a store. I'm eating a plate of food with a salad and sandwich.” Ten to twenty years ago we were trying to identify circles and images; now suddenly we have computers that can recognize content and write English sentences.

There are also a lot of signs that something is not quite right about AI. This is kind of confusing as a person working in the community, and I think it's also confusing for the public. We see headlines about things like autonomous vehicles that detected a pedestrian but “chose not to stop.” There are problems with bias in algorithms—there are recent research results showing that face recognition works dramatically better if you're white than if you're black, for example. Then there are curious problems like the “D.C. security robot that quit its job by drowning itself in a fountain.”

So, we have AI systems that can play chess better than any human who has ever lived but are apparently no match for a totally obvious fountain, which they may drive themselves right into.

A lot of the problems with AI can be traced back to the techniques that we're using, so I thought I would give you a short introduction to the way that we solve these problems. We are currently using machine learning for almost all of the problems in computer vision. When you apply a machine learning technique, you collect a lot of image data. If you want to classify cats versus dogs, you first collect a bunch of images of cats and of dogs, but they need hundreds of thousands, or millions of training examples. From those training examples, they try to build a mathematical model of what this concept is. All it's really trying to do is fit some sort of mathematical function to the data.

The reason this often goes wrong is that there's inherent ambiguity in fitting mathematical models to data. If we were back in junior high school, and we were in some physics class and you had collected this data and I said okay, "Draw a model or find a model to relate this data," the natural thing to do would be to draw a line of best fit. That's basically machine learning—you fit a line to your data. The problem is that you had to use some human intuition to know to draw a line. You could have drawn a curve, or created a mathematical model that is actually a perfect fit to the data but is going to make all kinds of prediction errors through the machine learning model. And then we have massive amounts of compute power. The techniques that we need—the mathematical operations underlying machine learning—are just addition, multiplication, subtraction, and so on. They are the same techniques that the arithmometer had 200 years ago, but Big Red 200—IU's supercomputer—is something like 100 quadrillion times faster. Having all that compute power really matters for machine learning.

Keeping in mind what is really powering AI—big amounts of data fitting mathematical models using enormous compute power—explains some of these mysteries. The

systems are really good at quickly comparing many images they've seen before, but they can also make up mathematical models of data that don't agree with human perception. Besides these technical concerns, there's also a lot of concern about the impact of AI on society, including ethical concerns and the effects on the labor market.

It's against this backdrop that I want to talk about the recent work that we're doing on the AI Institute for Rural Health, Wellness, and Resilience. Last year, the National Science Foundation launched a new funding opportunity to set up many AI institutes around the country that would study specific problems. We applied for and received a NSF grant to begin planning an AI Institute for rural health, wellness, and resilience. We tried to think about the best way that Indiana can contribute to the AI landscape. If you look at the best states for AI research or AI jobs, obviously Indiana isn't really a major player. If you look at other metrics like the institutions with the most accepted papers at major AI conferences, you'll see that it's dominated by a lot of big players, including Google, a company that is really dominating academic AI research. They had almost 200 papers at one conference.

What could Indiana bring to the conversation about AI that would be new and different? We are in a very good place to be able to think about how AI impacts rural communities, including ways AI could help rural communities with issues that they face.

If you look at certain rural Indiana communities, such as Greene County, you can see some of the issues compared to the rest of the state. The average age is a bit older and access to high-speed internet is significantly lower, which poses problems for bringing AI technology to these communities. In thinking about the health and wellness issues facing these

communities, you come across health risk factors such as obesity, physical inactivity, and nutrition concerns. When you look specifically at maternal health, Indiana ranks very poorly—it's 49th in the country by some measures.

We're just getting started, but it is to be an inherently interdisciplinary resource. We have three focus areas of health: specifically on maternal health; wellness, specifically on healthy aging; and resilience, specifically on environmental and economic resilience. We plan to bring together researchers across the university and across the Midwest, and also hope to involve folks from industry.

In order to solve problems, we need technical innovations, so we've also identified five key pillars, or technical areas of AI. These pillars include: Trustworthy AI, AI that is secure and doesn't make mistakes; Explainable AI, so that we can figure out what goes wrong when something goes wrong with these AI models, and we can have greater

confidence in what they are predicting; Human-centered AI, so that we really design for human and computer collaborations, as opposed to thinking about AI as replacing humans, which is a fear that many people have. Ubiquitous AI looks at how we can deploy this technology in places where broadband access as a challenge, through low-power kinds of devices and scenarios. And finally, Ethical AI, to wrestle with the ethical issues that come up as we apply this technology.

Over the next year, the first step of this project is to conduct a series of workshops where we're bringing together people from around the university, from around the Midwest, and from rural communities to get together and think about the technical challenges we need to solve, the societal challenges we need to study, the opportunities that exist within rural communities, and how can we all work together in order to achieve this overall vision.

What could Indiana bring to the conversation about AI that would be new and different? We are in a very good place to be able to think about how AI impacts rural communities, including ways AI could help rural communities with issues that they face.

Analytics for COVID-19 Response and Surge Planning

KELLEY RESEARCH SPOTLIGHT



December 4, 2020

Presented by:

Jonathan Helm, Associate Professor, Grant Thornton Scholar, Kelley School of Business, Indiana University

We approach data analytics from an operational perspective, which makes it a little like tech companies versus manufacturing—tech companies are cool and whiz-bang, manufacturing is considered a little bit long in the tooth, a little older school. And what's more old school than a hospital? They are not even at the level of some of your most basic manufacturing or service operations. In fact, it was COVID-19 that made them even start thinking about using data analytics in the first place. We've seen a huge transformation at IU Health, where they had a ton of data, but they were still making decisions in an intuitive way, rather than quantitative database decisions.

COVID-19 came along in mid-March of last year in Indiana. And all of a sudden, everyone in the state—every hospital in the state—wanted data. They wanted to know what things are going to look like and when they were going to run out of beds.

IU Health is the biggest health system in the state—they have 18 hospitals and serve over a million patients in five regions throughout Indiana. Their nursing workforce alone is about 9,000. They're huge. We had a call from them on the 19th of March, and on the 21st we had our first prediction model up and running. Over the next three months, we built some machinery that's been integrated into their system, which is used for both COVID-19 predictions as well as predictions specific to IU Health

In mid-March to early April, hospitals were trying to figure out if they had enough ICU beds, enough ventilators, and enough staff—what would they need to take care of patients? In the fall, different predictions of the number of active COVID cases in Indiana made by a variety of national organizations ranged between 4,200 and 22,000. The hospitals saw all of these analytics, and wondered who on earth to trust, or whether to trust any of the numbers—Do they pick the Google-Harvard University prediction at 6,700? Iowa State at 6,100, or maybe the outlier at 22,000? Intuitively, I'd pick something near the last real data point—around 8,000 to 10,000—something that looks more reasonable. It turned out that four weeks later it was actually 26,000 cases—higher than the highest model out there.

So, when IU Health asked us to come in, we initially looked at it from the operational perspective, believing that a COVID predictive model was a given. There were so many of them out there that we were sure we could find a good one. Then we could try and predict how many ICU beds IU health would need over the next four weeks, two months, and so on. We soon found out that there weren't any reliable epidemiological models out there, so we ended up doing both. We are not epidemiologists, but we do know something about optimization and machine learning. So, we used a basic epidemiology model out of Harvard and created a machine learning engine underneath it, and it worked a lot better than the existing models because of its simplicity and adaptability.

I am part of the Indiana Pandemic Information Collaborative (IPIC) team, which is a consortium of companies, academics, and government leaders focused on COVID-19. On one of our calls, a CEO of a major hospital system told us that national and state models were essentially useless to him in planning his hospitals' response. Because a national model is a national model, it's not going to tell you who's going to show up at your hospital—they are not tailored to the state level. Some may predict at the county level, but they aren't tailored to the county level.

There was a model that was widely promoted in the state of Indiana and used very broadly, that basically said that every county should have the same shape of progression in the number of total cases. If you look at Marion County, which is where Indianapolis is, versus Tippecanoe County, where West Lafayette is—these are very different regions of Indiana. At the end of last April, Indianapolis was starting to spike, while West Lafayette hadn't even started—they had almost zero cases. In June, Indianapolis began to level off while West Lafayette started to see an exponential increase.

This is actually a good thing for IU health, because they own hospitals in Indianapolis and Tippecanoe County, and might be able to shift some resources. The fact that cases are spiking at different times is a good thing for a large hospital system that is able to spread out its resources.

But none of this could be done with any of the models that I found out there—you couldn't do any tailored, region-specific, hospital-specific modeling.

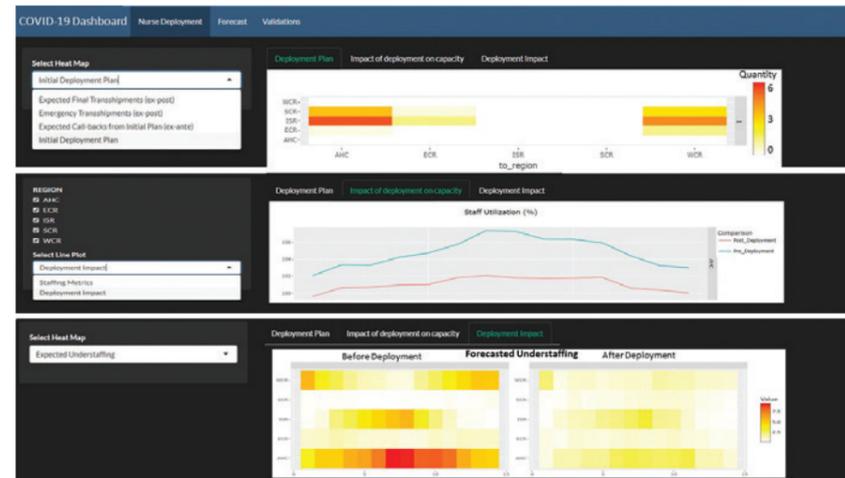
We wanted our model to give them what they need. The national disease models mostly ignored geographic variation because they were based on fitting the curve. They ignored the fact that disease transmission is time variant—the whole state shut down in mid-March, and that changed the transmission dynamics significantly.

Then the state reopened, but in fact cases started going up before the state reopened. Structural models that include the fact that the state is going to reopen to predict transmission rates failed too, because a week and a half before the state reopened, cases started spiking again because people got tired of quarantining. We wanted a very simple model that would dynamically detect those changes without caring why they're happening, because if you care why they're happening, you're never going to get it right—those models are way too sensitive to the input parameters.

Connecting COVID cases with hospital admissions is tricky. You could do that based on national averages, which everyone else does, but the hospital admissions in Indianapolis relative to number of COVID cases is different than in West Lafayette and that is different than in Bloomington. We also need a hospital admission to a specific hospital system. Indianapolis has about 10 to 12 major hospitals around the city and its suburbs. So how do I know which one of those admissions is going to go to IU Health? And IU Health itself has four different hospitals within the Indianapolis region.

That's where the machine learning comes in, you can start with market share, for example—IU Health has X percent of the market share, therefore X percent of COVID cases will go to IU Health. It turns out this was not the case at all. Early on in the pandemic, more cases went to IU health relative to their market share. Why is that? Because IU Methodist in Indianapolis is the best-known hospital in the state. So, if I get COVID, and I don't know what it is early on in the pandemic, I go to what I think is the best hospital. And that dynamic changes over time—nothing is static in a pandemic outbreak.

A screenshot of the Covid-19 dashboard



Then we come to resource usage. National models take the number of predicted cases multiplied by the percent that need an ICU, multiplied by the average ICU length of stay, nationally. ICU lengths of stay at IU health are very different than national averages. They have also changed over time, as different policies about different types of treatments and different administrative policies relative to COVID patients emerge. None of these national models were going to give us any kind of fidelity.

So, we created this modeling framework, starting with IU Health's incredibly detailed data. Unfortunately, it's not really clean data. I spent two weeks cleaning the new data in preparation for re-parameterizing our model for December 2020 through February 2021. And we couldn't forget about the non-COVID patient data. National models predict COVID, but the non-COVID patients are still there, and their characteristics are changing. There have been 20 to 30 percent fewer emergency patients during COVID, because people have been scared to go to the hospital. They cancelled elective surgeries, then reopened elective surgeries, so how do you create something that can adapt to this incredibly dynamic environment?

Our forecast has machine learning components about the fraction of cases that go to IU health, and how resources are used—whether patients go to an ICU, to medical/surgical (medsurge)—or to medsurge and then to an ICU four days later.

This time series is something that's missing. If I tell you that, on average, you're going to have 20 patients in the ICU, but you know exactly how many patients you have in the ICU today. If that number is five, is that average number of 20 really helpful? Not really. You have to take where you today, and then run the time series. You can't base this on averages because everything is so dynamic.

Our epidemiology model makes it simple, because we have found that simple models are often better and easier to tune. The amount of data that algorithms can handle depends on how many parameters you're trying to apply. We essentially have two parameters: One is the transmission rate. Two is the fraction of patients that go undetected—that don't show up in the statewide or the region-wide detected COVID cases. All we see in the data is the tip of the iceberg. We see the people who tested positive for COVID, we know there are asymptomatic people, we know that there are a lot of people who just got sick and quarantined by themselves and never went to get a COVID test. So that's a fraction we had to estimate.

With those two parameters, we projected out 15 days, and our average error was one percent in Indianapolis and .65 percent in the suburbs—we were getting similar predictive values, which is all we need for operational planning. The other cool thing about this is that if something changes, we detect it, because we have a statistical method to determine if the transmission rate



has changed from one period to the next. We're not forecasting changes, but we're detecting them as soon as they happen.

It's impossible to know if the governor is going to shut down the state two weeks from now or how many people are going to get sick after Thanksgiving. But after Thanksgiving, we'll be able to get that transmission rate and be able to figure out if something has changed. So, we're not prospective, but we're pretty fast at detecting new changes. All the prospective models I've worked with, including ones from Georgia Tech, and MIT—again, they're really sensitive and generally really terrible, at least for the state of Indiana. We tried a couple of agent-based models here, and they just bombed compared to what we've got. They are too complex with too many parameters to estimate. We found it's better to keep it simple.

Remember, the highest projection out of about 30 well-known prediction models for the fall in Indianapolis was 22,000, and the actual number turned out to be 26,000. This is because they based it on actual candidate-confirmed cases. We based ours on confirmed cases, plus estimated cases—that includes people walking around with COVID that don't know they have it and those that are self-quarantining. Most models have underestimated what really is going on. We don't, because we cover both what we're seeing in the data, and what's under the iceberg, which is all those people with COVID that never get a test.

Resource usage is where forecasting becomes useful. Everyone has focused their time on predicting the disease outbreak, with little effort on figuring out how it's going to affect hospitals. And when they do, they predict how it's going to affect the hospitals in the entire city of Indianapolis, which is not very helpful if I run IU Health. How do I know they're going to Franciscan or Community or any of the other hospitals? We take the cases in the count, we map them according to who is going into the hospital, and then we map them to how long that patient is going to stay, what resources they're going to use, and the timing of those resources.

Our first predictions in Indianapolis for ICU and medsurge were pretty helpful. Our mean absolute percent error is 8 to 9 percent—a little higher than our epidemiology model because we added a lot more complexity and variables to the estimate. We also integrated two things, so you expect the error to go up. The numbers are also a lot smaller—an 8 percent error for a 10-bed ICU is .8 patients—not really a big deal operation. And we have since created new models that are even more accurate.

The data is implemented on the IU Health COVID-19 dashboard, where you can select the region, change or cancel electives, and see how the census reacts in ICU. It predicts workload in ICU/medsurge vents, and for nasal canula, which we recently added because apparently that's another intervention that's being used. They use this

tool to pick predict hiring, because they know they're going to have to hire some temporary nurses and travel nurses to cover any upcoming surge. We use our model to predict when and where we are going to spike. You don't want to hire enough nurses to cover all five regions at the same time, because we know they don't spike at the same time. We have to figure out the maximum number we need to surge up to any point in time, across the five regions.

This has already been used for surge planning—they've created their surge plans based on our modeling efforts. We also have installed warning flags, one of which went off for Muncie, Indiana, recently, and then Muncie spiked, and started getting really full.

IU Health is now applying this into nurse staffing, to predict how many nurses are needed in ICU in an upcoming 24-hour period. They wanted to know whether they will need to move patients or nurses around—from Indianapolis suburbs to the city, or up from Bloomington—three days in advance. They also wanted to predict how many nurses to hire for flu season plus COVID.

Supply chain planning is also a huge issue. When things get really bad, everyone is trying to purchase supplies at the same time; if you can have a little advanced warning, you can purchase ahead of everyone else and proactively avoid that.

Local Development Model at Center for Rural Engagement

O'NEILL RESEARCH SPOTLIGHT



December 4, 2020

Presented by:

Justin Ross, Associate Professor, O'Neill School of Public and Environmental Affairs

I do applied research on a local development and public finance model that was commissioned through the Center for Rural Engagement to help decision makers around Indiana answer some fairly basic questions about property tax impacts from proposed development. It is essentially code that you can download from the Center for Rural Engagement's housing-ready toolkit that runs on a free open-source platform called "R."

When a development is being proposed—such as a new apartment building, a new residential neighborhood, or a sports facility—the idea here is to find out what the impact of those facilities will be on the property taxes in Indiana, including tax levies, property tax revenues, and property tax rates. The code runs fast and allows for a lot of flexibility and creativity.

The need for this arose because property tax caps—which are the main barrier to doing this kind of analysis well—need to be understood. The property tax caps are about 10 years old now, and they were marketed to the public as being "easy as 1-2-3." The name of the policy was inspired by the idea that your combined property tax bill cannot be more than one percent of your property's value if you are a residential homestead, two percent, if you're a nonresidential homestead or agricultural property, and three percent for everything else.

As a result, a lot of policy makers have wondered if residential is one percent, shouldn't we favor three percent? Property tax caps have a lot of counterintuitive effects. In several instances, they take things that seem like they should be intuitively true and render them incorrect. Let's take two property types of equal market value—a homestead that has a 1 percent cap, and a commercial property that has a 3 percent cap, both worth \$150,000. Your initial thought may be that you will get more possible tax revenue out of the commercial property. At the very least, that analysis is incomplete, because there's a distinction between what is market value and what is taxable value. This gap is quite large, particularly for residential properties.

There are a lot of exemptions and deductions that apply to residential homesteads that are not available to commercial plots. So, for a property that is about \$150,000 in Indiana, the taxable value is likely to be somewhere just north of

\$65,000, whereas there is still going to be a taxable value of \$150,000 for commercial. When we go and take that market value to calculate the maximum tax bill, the maximum tax bill is going to be \$1,500 for the homestead and \$4,500 for the commercial.

When we ask what property tax rate you need in order to hit that cap—which is not the same as just one percent and three percent—you're trying to apply this to the taxable value. If you just compare those, the homestead needs a 2.3 percent property tax rate in order to hit its maximum cap, whereas the commercial property just needs the three percent, because it doesn't have any deductions. In this kind of case, it's still true that the three percent gives a bit more room, but the gulf between it is not one percent and three percent. It actually requires you to ask a different question altogether.

Property taxes are not exactly like other taxes. Most taxes that we think of operate under a specific rate—the government defines the rate, people buy or sell under the rate, and then that produces revenue. With a sales tax, you buy some goods, that sales tax rate is applied, and the government collects revenue. Property taxes reverse this order. The government sets its budget, spending property tax rates are calculated based using taxable values—not market values but taxable values—and then individual taxpayers use that rate to determine their share of the budget.

When we're going through the phase of deciding how the tax budget is going to be apportioned amongst the properties, the property tax cap means that not everyone has to pay their full share of the bill. If we have two different property values, one with a lower gross assessed value, and one with higher gross assessed value, there's a larger wedge for the lower value.

In an analysis I did for Lake County, which is close to Chicago, we took a bunch of residential neighborhoods that were worth about \$2.5 million and imagined we just leveled that neighborhood and replaced it with a \$25 million commercial property. In a sensible world without the property tax caps, this is an obvious homerun—you just increased the value of your property tenfold. But the distinction is that the homesteads have these

kinds of deductions that are built into them, and this changes the effective rates at which things get applied. Now you're basically adding, in the case of a commercial investment, a scenario where a taxpayer who is going to be responsible for a large share of the budget doesn't have to pay it all. By replacing the neighborhood that came to about \$2.5 million with a \$25 million commercial investment, the revenue to the local government actually goes down by about a about \$200,000. It is not the case that they end up coming out ahead with this.

When this was passed, this was not very well understood. Some local governments were quite surprised. For example, when some local governments and municipalities annexed property into their jurisdiction, they thought they would have a greater tax base. Then their revenues went down because they were adding properties to their base that didn't have to pay the full share of their tax bill. So, their budget got divided amongst a larger number of taxpayers that didn't have to pay.

Some of the implications of this are that you can't easily rely on higher assessed values and higher cap rates to tell you that you are going to end up with more revenue. And if you actually work through the logic of this, taking certain high-value properties out of the tax base can actually increase your revenue, which is what makes things challenging here.

So, to increase your revenue base, what you actually want to do is try and add the development types that are under the caps and can redistribute the burden away from properties that are over the cap. The short version of what you're trying to accomplish if you're trying to manage your development around this constraint.

To come back to the model—it runs through simulations of these types of calculations. It can be pulled right off of the webpage with a user guide that explains it. So basically, a user can upload the before and after taxpayer records—before the developments and after the proposed developments. When you upload local government budgets into the model, it generates a couple of different scenarios. One of the scenarios assumes that the budget is going to be constant and you will just redistribute the tax burden under the new development. The other assumes a constant tax rate, where



you'll keep the tax rate constant, and attempt to increase spending available under the new development. Under these two different scenarios, the model then produces a collection of spreadsheets with different values in them to help answer these questions.

One thing about the property tax caps is that property taxes actually stack on top of each other. Many people describe property tax as a layer cake. If you were looking at the property tax bill that you pay as a property owner, you would see that there's a rate that goes to the county, there's a rate that goes to the city, and to townships if you have those, to school districts if you have those. The tax bill that you pay gets apportioned to the different units. If you're subject to the cap and you don't have to pay the bill, what you don't pay is similarly distributed to all the overlapping governments in proportion to their tax rate share.

When a property is over the cap, its unpaid portion is actually attributed to each of the taxing units and in proportion to the rate. If the city is half of your total tax rate, and the property tax caps protect you from \$500 in property tax payments, then the city's share of the lost revenue is \$250. If half of your property tax bill is coming from the city, then half of the unpaid portion of your bills is going to be attributed to the city.

Another implication this has is that some of the rate-raising behavior that you see amongst local governments is not actually causing the taxpayers to pay more in a property tax bill. What it's doing is redistributing what the taxpayers are paying amongst the local governments. We started to refer to this as cannibalization. If all of your taxpayers were at the cap, the only way you would get more revenue is if you raise your tax rates faster than everybody else raises theirs.

As an illustrative study, let's take all the undeveloped properties throughout the Indiana Uplands region, randomly select on percent of them, and then redevelop them as residential homesteads with the median value in the county. What would be the implications for the property taxes in the area?

When you run the model, you take all of the taxpayer records and pick out the properties that are undeveloped, which are typically very low value. Then you redevelop them at one percent of the median value. You get all of these spreadsheets as a result that will tell you the answers to different questions for the different governments in each county, such as how the levies and property tax revenues change, or how individual taxpayers' tax rates would change.

The model shows that if some of the local governments in the region redeveloped undeveloped properties into something of median value, they actually would experience revenue declines—it's not entirely hypothetical. It means they would need to do something more clever than just randomly picking properties to redevelop.

Over the summer, a pair of interns at the Center for Rural Engagement looked at a very specific city proposal in French Lick to redevelop 20 specific units, and they had an estimate of what the value of those properties would be at the end of it. When they ran that particular proposal through the scenario, they came back with this kind of analysis of it: if they just kept the property tax rates constant, the local governments in the county would collect about \$28,000 more in annual property tax revenues, with about half of that going to the city's school districts. The property tax caps would also increase by about \$670. If, on the other hand, they just use the increased property values to lower their property tax rates—if they just lowered the property tax rates for everybody else—then the local government would actually still receive more in revenue by about \$16,000, because of how many properties were subject to the cap throughout the rest of the area.

If you're interested in more, I encourage you to go check out the toolkits. The steps are quite simple. You would just visit the website, download the model guide and the model itself.

GT-IDEA Faculty Scholars

Indiana University Faculty

Kelley School of Business
Luddy School of Informatics, Computing, and Engineering
O'Neill School of Public and Environmental Affairs

Claudia Avellaneda

Associate Professor
O'Neill GT-IDEA Scholar

Born in Colombia, Dr. Claudia N. Avellaneda specializes in governance and public management in developing countries, with an emphasis on local governments. She joined the IU O'Neill School of Public and Environmental Affairs in 2013, after serving as an assistant professor in the Department of Political Science and as a graduate coordinator of Latin American Studies at the University of North Carolina-Charlotte. Her main research interests are decentralization, public policy, innovation, governance, and public management, with a regional focus on Latin America. Specifically, Professor Avellaneda investigates determinants of government performance in Latin American municipalities by focusing on the role of the local chief executive — the mayor.

David Crandall

Director of Graduate Studies for Computer Science
Professor of Computer Science
Director of Center for Machine Learning
Luddy GT-IDEA Scholar

David Crandall received a Ph.D. in computer science from Cornell University in 2008 and M.S. and B.S. degrees in computer science and engineering from Pennsylvania State University, University Park, in 2001. He worked as a postdoctoral associate at Cornell from 2008-2010, and as a research scientist at Eastman Kodak Company from 2001-2003. Dr. Crandall's main research interest is computer vision, the area of computer science that tries to design algorithms that can "see". He is particularly interested in visual object recognition and scene understanding. He is also interested in other problems that involve analyzing and modeling large amounts of uncertain data, like mining data from the web and from online social networking sites.

Aaron Deslatte

Assistant Professor
O'Neill GT-IDEA Scholar

Aaron Deslatte joined O'Neill as an assistant professor in 2019 and directs the Metropolitan Governance and Management Transitions (MGMT) Laboratory. His research focuses on the roles that public managers play in enhancing economic, environmental, and social sustainability at the local and metropolitan level, with the goal of building cumulative knowledge which can help local governments advance sustainable economic and community development.

April Grudi

Director, Master of Science in Healthcare Management
Assistant Clinical Professor
O'Neill GT-IDEA Scholar

Professor April Grudi joined O'Neill in 2018. Grudi spent the prior decade providing strategic and operational leadership in a variety of roles at Indiana University Health. Most recently, she led a team of trainers who supported both system level and business unit development through the use of a Lean operating model. Grudi also provided support and coaching to senior executives in the fields of leadership development, change management, and new leader onboarding activities.

Dan Grundmann

Senior Lecturer
O'Neill GT-IDEA Scholar

Daniel J. Grundmann specializes in the field of human resource management, is a Senior Certified Professional (SHRM-SCP) with the Society for Human Resource Management, and has maintained certification as a Senior Professional in Human Resources (SPHR) since 2000. He worked for the City of Bloomington for 17 years, including 13 as director of Human Resources, where he helped drive the complete revision of the compensation and benefits structure for the City, the development of performance appraisal and job evaluation systems, the implementation of a Human Resource Information System, and employee handbook and policy manual revisions. Grundmann has taught at IU since 2002. He was honored to receive a 2012 Teaching Excellence Award from IU's O'Neill School of Public and Environmental Affairs for his accomplishments as an adjunct faculty member. Also that year, he earned a Society for Human Resource Management Academic Award.

Dana Habeeb

Assistant Professor of Informatics
Luddy GT-IDEA Scholar

Dana Habeeb is an assistant professor in the Department of Informatics at Indiana University. Trained as an architect and urban designer, Dr. Habeeb brings a design perspective to her research in environmental planning and health. With a focus on designing local interventions, she investigates ways to engage and empower individuals to respond to current and future environmental problems by synthesizing research in climate change, public health, and environmental sensing. Her research explores how climate responsive design can help mitigate climate change and address environmental challenges to improve the health of individuals and communities.

Jonathan Helm

Associate Professor
Kelley GT-IDEA Scholar and Co-Director
Life Sciences Faculty Research Fellows
Center for Business of Life Sciences

Jonathan Helm joined Indiana University in 2012. Formerly, he held operations management and supply chain roles at GE Healthcare and Mayo Clinic. He is a three-year National Science Foundation Fellow. His research aims to improve the delivery of health care at three levels: the system level, the organizational level, and the individual patient level. Specific interests focus on patient flow, readmissions, and disease monitoring and treatment. He won the 2018 Pierskalla Award for Best Healthcare Paper at INFORMS and was a finalist for the 2018 POMS Most Influential Paper award for 2015–16. He was selected to give a Showcase Presentation at the 2014, 2015, and 2018 POMS College of Healthcare Operations Management (CHOM) Conference for implementation of three different research projects in hospitals and nonprofit organizations. He founded an interdisciplinary research group encompassing business, engineering, and surgical faculty at Indiana University, University of Michigan, and University of Pittsburgh and has collaborated closely with Mayo Clinic, National University Hospital (Singapore), and the MESH Healthcare Coalition in Indianapolis.

Diane Henshel

Associate Professor
O'Neill GT-IDEA Scholar

Dr. Diane Henshel is an internationally known systems-based risk assessor working across diverse systems and disciplines. Her research addresses the multidimensional problem of integrating disparate metrics across the many dimensions of multilevel systems. Her main research foci encompasses the fields of environment, health, and cybersecurity, which have begun to overlap in ways that will increasingly impact global security as climate change causes stresses in both natural and anthropogenic (and joint) systems. She is an associate professor at SPEA specializing in risk and resilience assessment, cybersecurity risk modeling, risk communication, and toxicology. She spent a year as the executive director of the Risk Assessment Forum at the EPA. She is also the principal and owner of Henshel EnviroComm, a consulting firm specializing in supporting both government agencies and communities addressing chemical contamination.

John Hill

Clinical Associate Professor
Co-Director Digital Logistics and Transportation Workshop
Kelley GT-IDEA Scholar

John Hill has been a faculty member with the Kelley School of Business in the Department of Operations and Decision Technologies for six years. He was previously an assistant professor of mechanical engineering at Michigan Technological University. His industry background includes positions as engineering manager for R&D at Eaton Corporation and product development engineer for General Motors. John received his bachelor's in mechanical engineering from Michigan

Technological University, a master's in Engineering from Purdue University, and both a PhD in industrial engineering and a MBA from the University of Iowa. He teaches courses in operations management and business analytics for the full-time and online MBA programs. He is co-director of the MBA Supply Chain Academy and has received multiple teaching awards.

Bryce Himebaugh

Clinical Assistant Professor of Engineering
Luddy GT-IDEA Scholar

Bryce Himebaugh's career has centered around embedded systems design and leadership. His work history includes positions at Intel (four-term co-op), Cummins Engine Company, Indiana University, and Analog Computing Solutions. He has held technical leadership positions at Cummins (heavy-duty controls hardware lead), Indiana University (Luddy director of information technology), and Analog Computing Solutions (chief technology officer and co-founder of this startup). He began teaching for IU's Department of Computer Science as clinical assistant professor in 2013 and moved to the Department of Engineering in 2018. He has taught undergraduate and graduate level classes on topics such as computer structures, embedded systems, C programming, operating systems, computer architecture, analog circuits, and cyber-physical systems.

Kari Johnson

Teaching Professor
Kelley GT-IDEA Scholar
Associate Department Chair, Operations and Decision Technologies

Kari Johnson is a teaching professor of operations and decision technologies and an award-winning educator with over twenty years at the Kelley School of Business. For the past seven years, Kari has served as faculty coordinator of an undergraduate business analytics course with over 1,000 students per semester. Kari also co-authored the textbook, *Introductory Business Analytics*, to help students master data-driven decision-making techniques and understand the value of data in today's business environment. In addition to teaching analytics at the undergraduate and graduate level, she also serves as a co-director for the Business Analytics Consulting Workshop at Kelley.

Antino Kim

Assistant Professor of Information Systems
Kelley GT-IDEA Scholar

Antino Kim is an assistant professor of information systems at the Kelley School of Business. Antino earned his PhD in information systems from the Foster School of Business at the University of Washington, Seattle, and a master's degree in computer science and engineering from the University of Michigan, Ann Arbor. His research interests include misinformation and social media, supply chain of information goods, digital piracy and policy implications, and IT and worker displacement. Antino's papers have appeared in the Journal of Management Information Systems, Management Science, and MIS Quarterly, among other outlets.

Antung Liu

Assistant Professor
O'Neill GT-IDEA Scholar

Antung Liu is an assistant professor at SPEA. His research interests include climate change policy and environment issues in developing countries. His recent work addresses carbon taxes and the unique properties that could make them attractive components of modern tax systems. He is also interested in pollution issues and the interactions between the environment and the economy in China, and he has studied transportation issues in Beijing extensively. His work on China's environment has been published in journals such as *The Journal of Development Economics* and the *Journal of Environmental Economics and Management*. Previously, Professor Liu was a visiting assistant professor of economics at the Cheung Kong Graduate School of Business in China and a fellow at Resources for the Future in Washington, D.C.

Alex Barsi Lopes

Clinical Professor of Information Systems
Kelley GT-IDEA Scholar

Alex Barsi Lopes is a clinical professor of information systems at the Kelley School of Business, where he teaches process modeling, systems analysis and design, data warehousing and visualization, big data, applications of artificial intelligence, and technology consulting management. He has served as director of the Technology Consulting Workshop since its creation in 2016 and has been responsible for GLOBASE and AGILE consulting projects in Guatemala, India, and Thailand. His research focuses on online information goods, collaboration technologies, face-to-face and online social networks, and IS educational initiatives, with his work appearing in journals such as *Information Systems Research*, *Journal of Management Information Systems*, and *Communications of the ACM*. Passionate about international education, Dr. Barsi Lopes has taken students to Thailand, China, India, Brazil, Guatemala, Mexico, and Canada. Before joining Kelley, he was the director of the MS-IS Program at the University of Cincinnati.

Jorge Mejia

Assistant Professor
Kelley GT-IDEA Scholar

Jorge Mejia is an assistant professor at the Kelley School of Business at Indiana University. Prior to joining Kelley, Dr. Mejia was a technology and management consultant, an industry analyst, and an entrepreneur. His research focuses on understanding the antecedents and impacts of social media through the analysis of large amounts of data. His more recent work examines how transparency in organizations affects social justice. He was awarded the INFORMS ISS Gordon B. Davis Young Scholar Award in 2021 in recognition of his work as a junior scholar in the field of information systems. He was also awarded the inaugural INFORMS ISS Bapna-Ghose Social Justice Best Paper Award in 2021 for his work uncovering potential biases in ridesharing. His work has been featured in multiple media outlets, such as NPR, CBS, and FOX.

Stasa Milojevic

Associate Professor of Informatics
Core Faculty of Cognitive Science
Luddy GT-IDEA Scholar

Stasa Milojevic is an associate professor in the Luddy School of Informatics, Computing, and Engineering, the director of the Center for Complex Networks and Systems Research (CNetS), a Grant Thornton Scholar, a core faculty of the Cognitive Science program, and a fellow of the Rob Kling Center for Social Informatics at Indiana University, Bloomington. Her research endeavors to elucidate the dynamics of science as a social and an intellectual (cognitive) endeavor by approaching science as a heterogeneous system comprising of people, ideas, documents, instruments, institutions, and policies situated in a historical context. Specifically, she strives to produce comprehensive, yet straightforward models based on theoretical and empirical findings from a wide range of fields (science, technology, and society (STS), science of science, information science, network science, economics, sociology, philosophy, history, etc.) in order to uncover and explain the fundamental principles that govern contemporary science. She serves on the editorial boards of *Scientometrics* and *BioScience*. She is an associate editor for *Quantitative Science Studies*, the *Frontiers in Research Metrics and Analytics*, and *Journal of Altmetrics*. She received her PhD in Information Studies at University of California, Los Angeles.

Mark Norrell

Senior Lecturer
O'Neill GT-IDEA Scholar

Mark A. Norrell teaches in the undergraduate program in health care management and policy at SPEA. He served in senior leadership positions at hospitals and health systems prior to coming to Indiana University. From 1987 to 1993, he served as director of strategic planning for a four-hospital system in Florida, where he was responsible for legislative and regulatory affairs and competitive positioning. From 1993 to 2002, he served as vice president of a 200-bed community hospital in southeastern Idaho, where he guided strategic development, operations, and competitive positioning, leading to acquisition of a local competitor. From 2002 to 2008, he served as executive vice president and chief operating officer for a 250-bed not-for-profit community hospital in central Kansas. Norrell holds master's degrees in health administration and business administration, as well as a bachelor's degree in medical

technology from the University of Florida. He currently serves as chairperson of the Monroe County (Indiana) Board of Health. He is a Fellow of the American College of Healthcare Executives and is a licensed nursing home administrator. Norrell teaches courses in hospital administration, health care reimbursement, strategic planning for health care organizations, health management ethics, and U.S. health care systems overview.

Nina Onesti

Senior Lecturer
Informatics and Computing Student Association Advisor
Luddy GT-IDEA Scholar

Nina Onesti is a senior lecturer in the Luddy School of Informatics, Computing, and Engineering. She also serves as the Informatics and Computing Student Association Advisor. With an M.S. in human-computer interaction design from IU, her research interests are in education, human computer interaction design, and pedagogy.

Charles Pope

Senior Lecturer
Assistant Chair, Computer Science
Luddy GT-IDEA Scholar

Charles Pope prepared profit and loss statements for the operations director, special accounts division for the largest wholesaler of wireless equipment before working at CompuCom, Dallas, TX, where he held various positions in call center management, including special projects, metrics, and reporting programs for Fortune 500 companies outsourcing help desk operations. He was a major accounts manager for a highly specialized network operations center in Austin, Texas, before moving to Indiana in 2001 to work for a telecommunications aggregator. In late 2003, he began teaching real-world productivity applications to IU students majoring outside of computer science. He has authored materials for one textbook by Hayden-McNeil, and two textbooks from Pearson Education. He currently serves as senior lecturer and assistant chairperson of computer science.

Justin Ross

Associate Professor
O'Neill GT-IDEA Scholar

Justin Ross is an associate professor of public finance and economics. He has been at SPEA since 2008, and holds a doctorate in economics from West Virginia University. His research expertise is in state and local public economics, and his research appears regularly in journals with policy and practitioner-relevant policy implications. In Indiana, he has provided testimony to the state legislature and consulting assistance to local governments on the implications for property tax cap impacts emanating from tax policy decisions on local income tax adoption and tax increment financing. His project, *A Fiscal History of Indiana Local Governments*, will be published this legislative session by the Indiana Fiscal Policy Institute. He lives in Bloomington, where he teaches graduate-level courses in public finance, benefit-cost analysis, and economics.

Sagar Samtani

Assistant Professor of Information Systems
Kelley GT-IDEA Scholar

Sagar Samtani is an assistant professor of information systems at the Kelley School of Business. Samtani's research focuses on Artificial Intelligence for Cybersecurity applications, including smart vulnerability assessment, dark web analytics, scientific cyberinfrastructure security, and cyber threat intelligence (CTI). His research initiatives have garnered nearly \$1.5M in prestigious funding, including the National Science Foundation (NSF) CISE Research Initiation Initiative (CRII), NSF Cybersecurity Innovation for Cyber Infrastructure (CICI), and others. He has published over two dozen peer-reviewed articles in venues such as *MIS Quarterly*, *Journal of Management Information Systems*, *IEEE Intelligent Systems*, *Computers & Security*, and others. He serves as a program committee member or program chair of leading AI for cybersecurity and CTI conferences and workshops, including IEEE Security and Privacy Deep Learning Workshop, USENIX ScAI Net, IEEE Intelligence and Security Informatics, and others. Samtani has won several awards for his research and teaching efforts, including the ACM SIGMIS Doctoral Dissertation Award and Nunamaker-Chen Dissertation Award (runner-up). His research has been cited in media outlets such as the Miami Herald, Science Magazine, AAAS, and Fox.

Patrick C Shih

Director of Graduate Studies for Data Science
Assistant Professor of Informatics
Luddy GT-IDEA Scholar

Patrick Shih is an assistant professor of Informatics in the Luddy School of Informatics, Computing, and Engineering at Indiana University Bloomington. He is an ACM Senior Member (top 25% of ACM). He directs the Societal Computing Lab (SoCo Lab) and is the director of graduate studies for Data Science. He is also the co-director of the Animal Informatics MS and PhD track and the BS Cognate, BS Minor, and PhD Minor in Animal-Computer Interaction, as well as a core faculty of the Health Informatics PhD track. His research focuses on how to better support health and well-being, specifically that of underserved and vulnerable populations, through the design, development, and evaluation of sociotechnical systems and community-based mechanisms. He also designs technologies to amplify human and animal capabilities in animal-assisted interventions, improve animal welfare, and cultivate empathy for others. Prior to joining IUB, he was a research associate and lecturer in the College of Information Sciences and Technology at Penn State. He received his Ph.D. in Information and Computer Science from UC Irvine, where he was a Chancellor's Fellow, M.S. in Information Networking from Carnegie Mellon University, and B.S. in Computer Science and Engineering from UCLA. He has also worked at Microsoft Research and IBM Research.

Haixu Tang

Professor of Informatics and Computing
Director, Data Science Academic Programs
Adjunct Professor of Biology
Luddy GT-IDEA Scholar

Haixu Tang is a professor and a Grant Thornton Scholar in the Department of Computer Science and the director of Data Science Academic Programs at Luddy. He received his PhD from the Shanghai Institute of Biochemistry, Chinese Academy of Sciences, in 1998, and conducted postdoctoral research at the University of Southern California and University of California, San Diego, before joining Indiana University in 2004, where he was promoted to professor in 2015. He was a recipient of the NSF CAREER Award in 2007 and the Outstanding Junior Faculty Award from Indiana University in 2009. His research interests include bioinformatics, data mining, and data privacy.

Owen Wu

Associate Professor of Operations Management
Kelley GT-IDEA Scholar

Owen Wu is an associate professor of operations management at the Kelley School of Business. His research focuses on the operations of conventional and renewable energy supply chains and their interfaces with energy markets. He has published articles on a variety of topics related to sustainable energy systems, such as integrating renewable energy resources, upgrading conventional resources, building energy storage facilities, investing in energy efficiency, and managing energy demand. He collaborates with industry practitioners and has advised sustainability projects at Cummins, BorgWarner, Boeing, DTE Energy, 3M, Graham Partners, Delphi, Dow, and UPS. Professor Wu received the Paul Kleindorfer Award in Sustainability in 2017 from the Production and Operations Management Society. His teaching excellence has been recognized multiple times.

Lu (Lucy) Yan

Associate Professor of Information Systems
Kelley GT-IDEA Scholar

Lu (Lucy) Yan is an assistant professor of information systems at the Kelley School of Business. She holds a PhD in business administration from the Foster School of Business, University of Washington. Her research interests include social media, social networking, and patient-centric health care models. Her recent studies investigate the impact brought by social media to health care, especially for patients with social diseases. She has published in *Information Systems Research*, *Production and Operations Management*, *Journal of Operations Management*, and *Journal of Management Information Systems*, among others. She is a member of the editorial review board of *IEEE Transactions on Engineering Management*.

Eunae Yoo

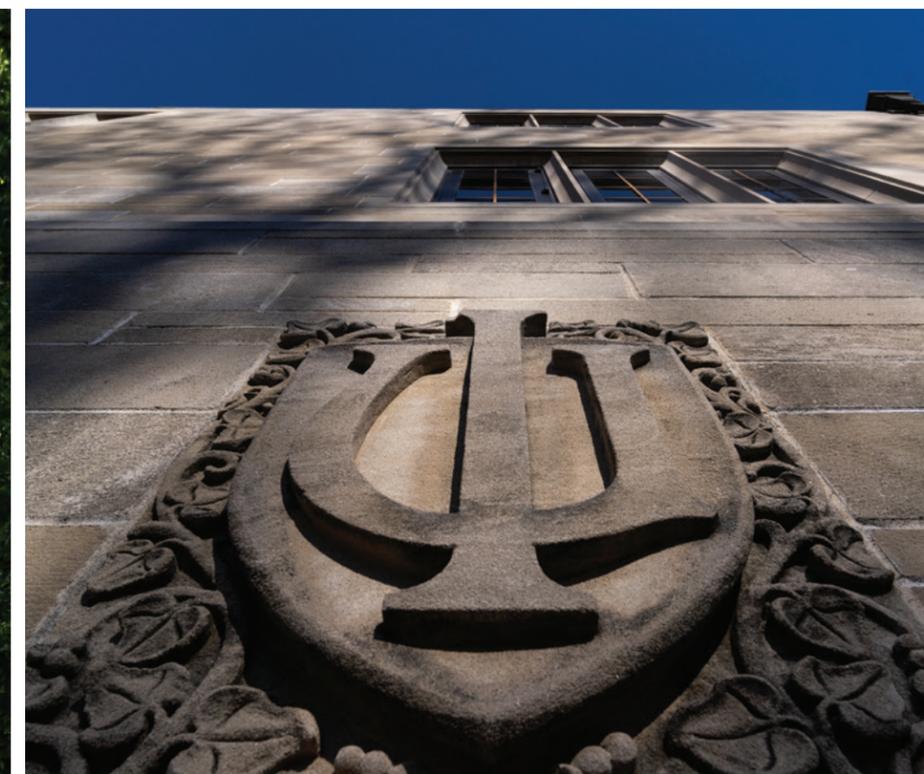
Assistant Professor
Kelley GT-IDEA Scholar

Eunae Yoo joined the Operations and Decision Technologies department at the Kelley School of Business in 2021. She earned her Ph.D. from Arizona State University, and prior to joining Indiana University, she was an assistant professor at the University of Tennessee. Eunae's research examines how online platforms (e.g., social media platforms, online volunteering platforms) can be leveraged to improve humanitarian and non-profit operations. Her publications have appeared in *Production and Operations Management*, *Journal of Operations Management*, and *Journal of Management Information Systems*. Recently, Eunae's research was awarded the Best Paper Award for the Humanitarian Operations track at POMS 2021 and was a finalist for the Chan Hahn Best Paper Award at AOM 2019. To conduct her research, she has established partnerships with multiple non-profit organizations, including the Canadian Red Cross, Humanitarian OpenStreetMap Team, and Medic Mobile.

Jingjing Zhang

Associate Professor of Information Systems
Kelley GT-IDEA Scholar

Jingjing Zhang is an assistant professor of information systems at the Kelley School of Business. She received her PhD in business administration from the Carlson School of Management, University of Minnesota, in 2012. Jingjing's research interests include personalization techniques, recommender systems, data mining, and human-computer interactions. Her research has been published in multiple leading academic journals, including *Information Systems Research*, *IEEE Transaction on Knowledge and Data Engineering*, *INFORMS Journal on Computing*, and *ACM Transactions on Information Systems*. Jingjing has received multiple awards, including the Inaugural INFORMS ISS Nunamaker-Chen Dissertation Award, 3M Pre-Tenure Faculty Award, and the IU Trustees Teaching Award. She was recently named to the "Top 50 Undergraduate Business Professors" by *Poets & Quants*.



What is GT-IDEA?

The Grant Thornton Institute for Data Exploration for Risk Assessment and Management (GT-IDEA) is an interdisciplinary institute that spans Indiana University's Kelley School of Business, O'Neill School of Public and Environmental Affairs, and the Luddy School of Informatics, Computing, and Engineering. With a focus on assessing risk both in terms of service delivery exposure and/or client risk, the mission of GT-IDEA is to leverage disruptive technology and unlock innovation in the market by integrating leading-edge technology with business and policy.



GT-IDEA Co-Directors



Eric Kinser

KELLEY SCHOOL
OF BUSINESS

Eric Kinser is a senior lecturer in the Department of Operations and Decision Technologies at the Indiana University Kelley School of Business. At Kelley, Eric has won multiple teaching awards and currently teaches both graduate and undergraduate courses. His course topics include spreadsheet modeling, visualizing data with Excel and Microsoft's Power BI suite, cloud-based analytics, and Visual Basic for Applications. In addition to serving as co-director for the Grant Thornton Institute for Data Exploration for Risk Assessment and Management (GT-IDEA), he is a co-author on the *Your Office* textbook series. Prior to joining Kelley, he worked in the medical field and in higher education as a technology and decision support specialist.



Andrew Chupp

O'NEILL SCHOOL
OF PUBLIC AND
ENVIRONMENTAL AFFAIRS

B. Andrew Chupp is a senior lecturer in the O'Neill School of Public and Environmental Affairs and is the faculty co-director of GT-IDEA for SPEA. He completed his PhD in economics from the Andrew Young School of Policy Studies at Georgia State University in 2009. Prior to joining Indiana University in 2018, Andrew held positions at the Georgia Institute of Technology and Illinois State University. He has conducted research on environmental policy and politics, with articles appearing in the *Journal of Public Economics*, *Public Choice*, and the *Journal of Environmental Economics & Management*, among others.



Travis Brown

LUDDY SCHOOL OF
INFORMATICS, COMPUTING,
AND ENGINEERING

As the senior executive assistant dean, Dr. Brown built and serves as the academic director of the Innovation and Entrepreneurship Program and Cross-Curricular Education, the executive director of the Shoemaker Innovation Center, and the point of contact for strategic discussions related to the commercialization of faculty research. Dr. Brown also holds a special academic appointment as an HCI/d Core faculty member, which entails teaching design strategy and strategic design and serving as a faculty advisor for the HCI/d master's degree students, as well as the co-director of the Grant Thornton Institute for Data Exploration for Risk Assessment and Management. In addition, he is the faculty advisor for the Ideation and Creation Entrepreneurs (ICE), the Shoemaker Scholars, and the Product Management Club. Prior to returning to Indiana University to pursue his doctoral degree, Dr. Brown spent his career within the intersection of business and technology, focusing on performance management, entrepreneurship, corporate innovation, business analytics, software development, and interaction design in corporate and small business settings.