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The Center for Discovery's pioneering innovations in the fields of education, healthcare and research, as well as $1 billion in economic impact over six years, are making transformative changes in the local community and the State of New York.

Located on 1,500 acres of land 90 miles northwest of New York City in Sullivan County, New York, The Center for Discovery (TCFD) provides healthcare and education services to more than 1,200 children and adults with complex disabilities, medical frailties, and Autism Spectrum Disorders. As a designated Center of Excellence by the New York State Department of Health and the Office for People with Developmental Disabilities, TCFD is a leader in the treatment and research of complex disabilities, including the development of residential, medical, clinical, and special education programs.

TCFD has a long history of innovation in curriculum development, program implementation, and assistive technology, leading to significant breakthroughs and life-changing opportunities. In partnership with researchers and scientists from major universities, TCFD is now undertaking pioneering studies...
designed to further advance understanding and improve care for those with complex disabilities. Furthermore, their recently approved Children’s Specialty Hospital will introduce a new, advanced model of care to New York State: highly specialized, short-term hospital care that includes integrated assessment, individualized treatment, and the development of effective strategies that can be carried out at home and in school upon discharge. This project is expected to save New York State millions of dollars each year by preventing long-term residential placements, returning children from out-of-state programs, and preventing inappropriate and repeated hospitalizations.

Leadership and innovation at TCFD has led to significant growth and economic impact over the past four decades. What started in 1948 as a grassroots effort with three parents is now a robust operation with more than 1,500 employees. Average wages at TCFD are 33 percent higher than the average private-sector wage in the county. TEConomy estimates that TCFD generated $193.1 million of economic activity for the State of New York in 2016 alone, through total direct, indirect, and induced impact; supported 2,119 total jobs with $111.9 million in compensation; and accounted for $9.9 million in state and local tax revenue. Since 2010, The Center for Discovery has generated more than $1 billion of economic impact for the State of New York.

What’s more, the vast majority of dollars coming into the local economy through TCFD are from sources that the community would not have seen otherwise. TCFD has garnered significant funding from federal, state, and private sources, and has fostered unique public-private partnerships to leverage philanthropic investments. As an example, a diverse coalition of stakeholders – led by The Center for Discovery – is working together to attract new businesses and develop a fully inclusive, accessible community in the hamlet of Hurleyville.

Thanks to TCFD, several adults with complex disabilities who may have previously lived in a sheltered institution are now able to live in accessible residences on Main Street, work at local businesses, and actively participate in cultural events held in a thriving community they call home. While advancing care and opportunities for these individuals, TCFD’s investments have brought employment and entertainment opportunities for everyone in the hamlet and surrounding area. The initiative is being documented and studied for replication in other similar, small-town communities.

The following in-depth report examines the impacts The Center for Discovery is making on the lives of individuals with complex disabilities, in the fields of education, healthcare, and research, and on the local and state economies.

By focusing on possibilities instead of disabilities and striving to create better care and opportunity for the most vulnerable among us, TCFD is investing in the building blocks of a better world for us all.
The Center for Discovery has been designated a New York State Center of Excellence in the Care and Treatment of Children with Complex Disabilities based on its internationally-recognized curriculum and programs, and its world-class school for children with complex disabilities, medical frailties, and Autism Spectrum Disorders. In both its pediatric and adult programs, The Center has pioneered a shift away from focusing on disability, and instead focuses on the abilities, accomplishments and potential of each child and adult.

By embracing a philosophy that a person’s physical, emotional, and psychological well-being and environment are interconnected and reinforcing, TCFD educates and cares for the whole child and individual. The Center’s curriculum emphasizes food and farming, health and wellness, and science and research as the basis for improved learning and an experience-rich life. The curriculum is aligned with New York State education standards and taught with consistency and excellence.
Including both its day student and pediatric residential program, TCFD educates up to 281 children, ages five to 21 years old. It is the largest residential pediatric program for children with complex disabilities and autism in the State of New York and draws students from 150 school districts and 19 counties, as well as from Pennsylvania, Connecticut, and New Jersey. The Center also cares for up to 166 adult residents, ages 22 to 83 years old, who are enrolled in the Adult Program and attend a day habilitation program. TCFD’s Discovery Health Center medical clinic treats an additional 700 people in the local community annually.

The Center’s children and adults have co-occurring conditions that include not only intellectual disabilities, but also gastrointestinal, metabolic, sleep, neurological, muscular, etc., disorders. The Center recognizes the inadequacy of single-disciplinary approaches to address the complexity of these co-existing conditions and the need for a better basic health foundation from which learning can occur. As Associate Executive Director Dr. Theresa Hamlin, Ed.D., states, “Over the past four decades, TCFD has worked to understand disability at its core and to develop programs from a foundational perspective.”

TCFD has taken a comprehensive, interdisciplinary approach in the design of its curriculum and clinical care that is evident throughout all its programs. Through the work of an interdisciplinary team of content experts including Drs. Theresa Hamlin, Nicole Kinney and Johanna Lantz, and Jennifer Franck, RD, CDN, The Center developed its core HealthE6™ educational framework. The six major components underlying the model are: environment (physical, social, and temporal), eating and nutrition, energy regulation (including exercise, sleep, and daily rhythms), emotional self-regulation, evidence-based approaches, and education.

In order to improve learning, each of the HealthE6™ components is intended to address key challenges facing children with complex disabilities and autism. These challenges and the way in which each HealthE6™ component addresses them are summarized in the following pages:
**CHALLENGE:** Research indicates that children with autism and other complex disabilities are disproportionately affected by and can become highly anxious in response to factors in the physical, temporal, and social environment.

**APPROACH:** TCFD has worked to create a built and natural environment that reduces stress and anxiety. This includes the use of color, natural light, small places in which to retreat, good cross ventilation, and wooden floors in The Center’s school and residences. Similarly, TCFD educators and staff are intentional in organizing the flow of each day, transitions between activities, and the communication of these transitions via visual schedules. Because friendships and social interaction are also important to emotional happiness and stress reduction, The Center uses social skills imitation and coaching to help students develop social interactions and friendships.

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**CREATING A BUILT ENVIRONMENT THAT REDUCES STRESS**

The Center’s Ridge Campus was designed specifically to decrease stress and anxiety and improve functioning for children with Autism Spectrum Disorders. Temple Grandin, a scientist and professor of animal science at Colorado State University who has autism, consulted with TCFD on the design of the pediatric residences in terms of colors, light, texture, and space. To increase overall access to outdoor environments, TCFD created 5 miles of paved walkways across its campus. Then at the community level, TCFD has invested in the creation of a vibrant, accessible downtown with amenities and outdoor recreation opportunities, including a Rail Trail that incorporates universal design elements aimed at getting students and residents outdoors and interacting with others in the community.
CHALLENGE: Clinical data suggest that 50 percent of individuals with autism have gastrointestinal (GI) problems, and that GI problems are much more common in people with developmental disabilities. Individuals with these GI issues are more likely to have sleep problems, behavioral problems, and lower health-related outcomes. Eating poor quality foods can exacerbate existing conditions in children with autism and other disabilities, such as stress, anxiety, GI and immune problems, behavioral difficulties, and sleep problems. Individuals with disabilities are also at a much greater risk for obesity and related health problems.

APPROACH: Recognizing that a healthy diet is important for long-term health, TCFD supports a plant-based, whole-foods diet through its farming operations, menu design and cooking, and educational programs. The Center's Food Exploration and Discovery (FED)™ Therapy helps children expand the number of foods in their diet and make eating enjoyable, and improves nutrition and health through the expanded diet.

FARMING & FOOD AT THE CENTER FOR DISCOVERY

TCFD operates five biodynamic and certified organic farms that span 300 acres. Today, TCFD is self-sufficient in the production of pork, beef, and vegetables, and meets half of its demand for eggs and much of its demand for herbs. In addition, The Center operates a Community Supported Agriculture (CSA) program, which provides fresh seasonal vegetables, fruit, and herbs to its members, many of whom are TCFD staff and their families.

Beyond its significant production capabilities, The Center's farming operation also provides ample opportunity for students and residents to be outdoors, physically active, and engaged in meaningful work with plants and animals. Both educators and farming staff are constantly seeking new ways for students and residents to participate in farming activities. For example, the educational staff, students, and adult residents run The Center's entire egg production operation. They are also responsible for transplanting thousands of vegetable seedlings, and in collaboration with the full-time farming staff, help with seeding, planting, and harvesting. Other adult residents enjoy caring for the animals, such as participating in their feeding, maintaining their stalls, and laying fresh hay.

As Greg York, Farm Services Director at The Center, said, “For me, there is immense satisfaction in growing food that is very clean and fresh, and harvested at peak ripeness within eyesight of where it is served to some of the most medically vulnerable children and adults.”
**Energy Regulation**

**CHALLENGE:** Despite the known benefits of exercise in curbing stress, anxiety, mood instability, attention deficit, aggression, and sleep disorders, many children and adults with autism and complex developmental disabilities do not get enough exercise or movement.

**APPROACH:** TCFD designed a vigorous exercise program for students that promotes aerobic fitness, balance, core strengthening, and overall body strength. Like exercise, sleep is also critical to energy regulation. The Center’s whole foods diet, orderly and structured routines, and vigorous exercise programs all contribute to reducing chronic stress, improving sleep, and helping children and adults to function and feel better.

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**Emotional Regulation**

**CHALLENGE:** Research demonstrates that children and adults with autism find it difficult to regulate their emotional responses to the positive and negative events that are part of everyday life. Additionally, children and adults with complex disabilities often have significant communication problems and many lack the ability to use words to speak, which can significantly affect emotional wellbeing.

**APPROACH:** TCFD employs functional communication training to teach children and adults how to communicate wants and needs with words, through picture symbols, voice output technology, writing, and/or gestures. The Center uses music therapy, mindfulness, yoga, vigorous exercise breaks, and connections with nature to reduce stress and improve emotional self-regulation. Finally, The Center teaches students how to be aware of their own and others’ moods and feelings through cognitive behavior therapy, Zones of Regulation, and other appropriate programs.
**CHALLENGE:** Individuals with complex disabilities often have co-existing medical and mental health conditions. If these conditions are untreated, especially those that cause chronic or acute pain, they can trigger maladaptive behavior. Despite the large number of studies demonstrating that individuals with autism and other disabilities have co-existing conditions, the tendency has been to focus on behavior without comprehensive biomedical assessment of underlying problems that may trigger the behavior.

**APPROACH:** TCFD conducts a comprehensive biomedical evaluation of each student and resident. These assessments are performed by a multidisciplinary team that includes physicians (primary and subspecialty); registered dietician; doctoral or master level special educators; physical, occupational, speech, and behavioral therapists; and other clinicians as needed. If problems are identified, they are actively treated under the care of an appropriate physician. Methods used to treat medical conditions are best practice and evidence-based.
New York State does not have any short-term inpatient assessment programs for children with complex developmental disabilities, including Autism Spectrum Disorders. As children with autism become adolescents, they may become more of a challenge, both in classrooms and at home. Teachers and parents may find it difficult to engage and support them, especially if they present challenging, maladaptive behavior. The innovative model pioneered by the specialty hospital will help children become healthier and stay integrated in the community.

The prevalence of autism in the U.S. has increased from one in 150 children in 2000 to one in 68 today. Medical expenditures and special services for children and adolescents with Autism Spectrum Disorders are substantial, and as young children with autism mature into their teenage years, states are finding themselves in the costly situation of requiring more residential placements.

Recognizing these challenges, TCFD is building a Children's Specialty Hospital to provide a short-term, clinical assessment program with the goal of better diagnosing underlying problems that affect behavior and learning. Improved understanding of underlying physiological and other medical and mental health problems will lead to better targeted treatments and interventions, all with the goal of enabling children and adolescents to stay at home and in school.

TCFD will be only the second healthcare provider in New York State to be certified by the Office for People with Developmental Disabilities and the Department of Health to operate a Children's Specialty Hospital. A key goal is to create a collaborative new system for assessing and treating children with complex developmental disabilities that can be replicated throughout the state of New York and beyond. Of the 18 beds, 12 will be dedicated to children with ASD with the other six beds dedicated to children with medical frailties and complex disabilities.

The Children's Specialty Hospital will conduct comprehensive medical and clinical assessments over a maximum of six months. Staff will engage parents, caregivers, and school district personnel as partners in the process.

“The Children's Specialty Hospital is a unique opportunity to change the way we address our children's needs before they become more severe, making life better for them and their families,” said Patrick Dollard, President and CEO of TCFD. “It is a challenge we are eager to embrace.”
**CHALLENGE:** As a National Research Council study\(^2\) points out, the goals for educational services for children with Autism Spectrum Disorders and complex disabilities are the same as those for other children: personal independence and social responsibility. However, the major challenge in educating children with Autism Spectrum Disorders and complex disabilities is the variability in the patterns of language, behavior, medical and mental health status, and cognitive development across children and over time.

**APPROACH:** TCFD’s curriculum is aligned with the NYS Common Core Standards and is both developmentally and functionally-based. Each program is highly individualized, structured, and guided by data that are aggregated on an ongoing basis. The program is results-oriented. If a child is not progressing, the team will meet to conduct a review of the program, and amend the approach as necessary.

A hallmark of TCFD’s education programs is the way in which staff tailor programs and technology to give each child choices, unique opportunities, and independence. Assistive technology adaptations are used to help students pursue activities that interest them, which might include animal husbandry, gardening, farming, working in a restaurant, pottery or fiber arts. The program also provides students with opportunities to participate in exercise classes, yoga, swimming, concerts, sporting events, and for older students, enrichment classes at the local community college.

Beyond its own classrooms, The Center has developed a Community Services department that provides community habilitation, intensive behavior services, Medicaid coordination services, and school district consultation throughout the region. The Center provides these services to community members ranging in age from 6 to 70, with a wide range of disabilities and complexity. “These services keep children at home and in public schools, and adults with their families,” program director Keith Rico said. “Parents are still able to go to work, and behaviors are managed effectively.” The program has only been in full swing in 2017, Mr. Rico said, but school districts are already renewing and expanding their contracts. With only three full-time staff members in the department along with part-time staff, the department is reaching about 100 families and seven school districts, and the department will continue to expand.
In 2015, TCFD was awarded a $2.7 million Balancing Incentive Program (BIP) grant through the New York State Office for People with Developmental Disabilities (OPWDD) and Department of Health to address the urgent needs of children living in New York State with Autism Spectrum Disorders, their families, caregivers, teachers, school personnel and service providers.

The Assessment, Support, Education, and Training (ASSET) Program supplied intervention services in the home environment, and training and support in the school setting, building a bridge between school and home for the 101 children aged 5-18 served. TCFD also organized two conferences that brought together many experts in the field, and equipped families and caregivers with the tools necessary to reduce the need for lifelong residential placement.

Along with the 101 children served, 755 family members, clinicians, school support staff, and other professionals were provided with intensive training and education to increase their ability to provide exceptional services to participants. Important screening tools to examine comorbidities in people with ASD and other complex disabilities were developed and continue to be researched.

The goal of this project was to provide the tools and training necessary to help keep children with ASD and other complex disabilities in their school and home environment, if at all possible, and 96% of participants have been able to remain in their home setting.

The HealthE6 framework is the foundation for the curriculum design of both The Center’s School and Adult Program. A hallmark of both TCFD’s education and day habilitation programs is the way in which staff tailor programs and technology in a person-centered way to give each child and adult choices and unique opportunities. For example, assistive technology adaptations are made to engage children in activities such as gardening, sledding and skiing, soccer, and therapeutic horseback riding. Assistive technology adaptations are also made for adults to make them as independent as possible in their interest-driven activities such as animal husbandry, gardening, farming, and pottery and fiber arts. The Adult Program also provides opportunities to participate in exercise classes, yoga, swimming, concerts, sporting events, and enrichment classes at the local college.
RESEARCH

The Center for Discovery has the resources and environment to study the interconnectedness of Autism Spectrum Disorders, complex medical frailties, and their many related health issues in a way that no other agency can.

The Center for Discovery has decades of experience assessing the connections between various health issues in medically frail individuals. Today, The Center is building upon this foundational knowledge as it pursues groundbreaking research into Autism Spectrum Disorders. Much of this is funded by philanthropists who believe strongly in the work of The Center, as well as grants awarded based on The Center’s innovative programs.

In The Center’s lab classroom, researchers use cutting-edge wearable technology to monitor students’ sympathetic nervous systems as they go about their normal classroom activities. The technology monitors stress signals, such as perspiration, skin temperature, and movement, combined with video and audio recordings of behavior and stress events. This detailed documentation allows The Center’s researchers to collect data that provides a more complete picture of what is happening when a student presents a maladaptive behavior, even if there were no outward signs of stress prior to the event occurring.
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**Nicole Withrow, Ph.D., M.S., R.D.**
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The Center for Discovery is uniquely positioned to research the complexities of autism and medical frailties, because it can collect real-time longitudinal clinical and lifestyle data and control for a host of confounding factors in the natural setting. Often, research in this field is conducted in a lab environment with induced stress.

The Center partners with researchers from top universities and medical facilities across the country, and has its own federally-approved Institutional Review Board, which approves, monitors, and reviews all biomedical and behavioral research projects, in conjunction with university IRBs for various research projects. TCFD abides by strict ethical principles in the conduct of its biomedical and behavioral research, and all participation by students and residents is approved with parental consent and individual assent.

The Center’s partners at the University of Missouri are currently preparing to publish joint research describing how physiological signals correlate with the behaviors of a child with ASD. It is the culmination of five years spent developing a sizeable data set, and the researchers are only just beginning to analyze this information. The goal is to identify causal connections that can have significant impacts on treatment of individuals with autism.

This is part of TCFD’s larger efforts to subtype autism—i.e., identify groups of individuals with autism who share similar biological underpinnings and potential longitudinal trajectories. To date, the high degree of heterogeneity among people with ASD has made subtyping difficult and intervention largely ineffective. Medical providers are left with only being able to address a maladaptive behavior without ever seeing the factors that created the behavior, or how shared health and environmental issues can lead to the same types of behaviors in different individuals.

The Center for Discovery seeks to subtype autism using a multi-pronged research approach. The Center is approaching “big data” clinical subtyping of ASD by leveraging two powerful and unique factors: its ability to conduct longitudinal studies on individuals with ASD and its ability to collect real-time data on a variety of potential biomarkers. Both are made possible because of The
Center’s residents and clinical program. Over the past five years, The Center has developed a valuable database of precise clinical data and potential biomarkers of physiological and behavioral correlates captured via the bio-metrics sensors on its wearable technology.

Such data are already yielding valuable insights. For example, TCFD’s data analysis has identified psychophysical reactivity in a subset of patients with ASD right before behavioral disturbances, activity which is not observed in other ASD patients. In keeping with The Center’s emphasis on translational research, these findings may have very near-term impact for treatment approaches with medications such as propranolol, which blocks a component of the stress response.

TCFD can conduct this type of research because it can collect real-time and longitudinal clinical data and control for a host of factors when trying to identify causal or contributing factors. TCFD employs an interdisciplinary group of staff who bring a variety of expertise to bear on the care and assessment of children and adolescents with autism—chefs, nutritionists, gastroenterologists, occupational and speech/language therapists, neurologists, primary care physicians, pharmacists, nurses, teachers, psychologists, psychiatrists, sleep disorder specialists, and other sub-specialty physicians. The research being conducted at TCFD has the potential to improve health and learning outcomes for the thousands of individuals worldwide who have Autism Spectrum Disorders.

**Recent Publications**

**2017**

**2016**


**2015**


The Center for Discovery has created an organizational culture that values and celebrates innovation, and has invested in a physical space for piloting and validating new ideas.

The Center’s leadership is deeply committed to giving students and residents the assistive technology to stretch beyond their current capabilities, often investing private philanthropic funds to do so. In line with this philosophy, The Center supports the development of disruptive methodologies and technologies that can have positive, life-changing impacts on children and adults with complex disabilities and Autism Spectrum Disorders.

An overarching goal of all biomedical innovation is to get treatments and devices to the people who need them as quickly as possible. Innovation starts with empowering people to identify important problems and articulate possible solutions, and then providing them with the tools and resources to prototype and test these concepts.

Historically, many of The Center’s innovations have centered on the development of comprehensive approaches to diagnosis, interventions, and curriculum. Disruptive to the status quo at the time, these methodologies and interventions are now accepted as industry best practices to achieving
improved health and educational outcomes for individuals with complex disabilities and Autism Spectrum Disorders. For example, the development of The Center’s HealthE6™ curriculum (see Education and Health section) for children and adults brought together an interdisciplinary team of content experts, all working toward the common goal of ensuring basic health as a foundation from which a child can begin to learn and discover happiness.

Other innovations resulting from the collaboration between The Center’s educational and clinical staff, and rehabilitative and assistive technology staff, center on the important challenges that students and residents encounter, and novel ideas for addressing these challenges. For example, the creation of The Center’s FlexTables™, which adjust to the seating height of multiple individuals seated around a table, accommodating different wheelchair heights. The Center was awarded a patent for this design and to date, has sold about a hundred FlexTables™. A more recent example is indieGo, a universal device that will transform any manual wheelchair into a powered chair. The Center received a $1.125 million grant from Google to commercialize the technology. (See indieGo case study.)

With the opening of the Hurleyville Maker’s Lab (HML) in 2016, TCFD has focused on increasing innovation activity in the broader community as well as within The Center. Currently, the HML’s technical staff, state-of-the-art computer lab, and rapid prototyping capabilities are supporting the growth in The Center’s throughput to more than 100 prototypes a year, which includes multiple prototypes of indieGo and many other projects (see A Tale of Three Prototypes). Outside of supporting projects emanating from TCFD, the HML staff is working with inventors in the community to help prototype a variety of ideas inspired by challenges encountered in their respective lines of work. HML also works with gardening groups; Boys and Girls Clubs; Girl Scout and Boy Scout troops; and other community groups, and has implemented an after-school Design Challenge with seven high schools. For the last two years, HML has co-hosted a green building course with the local community college.
SEED-TO-BELLY®

One of The Center’s first initiatives was to provide and grow its own organic food as a means of reducing chemical triggers and improving the nutrition of its students and residents. Organically grown food is free of pesticides and chemical fertilizers, but 35 years ago it was far more expensive than conventionally grown food.

In 1983, TCFD began a small, organic vegetable garden. Ten years later, TCFD purchased a 50-acre farm, which signaled the start of its larger-scale, commercial farming operation. Today, The Center has achieved self-sufficiency in the production of meat and vegetables for its students and residents via the operation of its 300 acres of certified biodynamic and organic farmland. It also operates a Community Supported Agriculture program, which provides seasonal produce to its members, many of whom are TCFD staff and their families.

Today, the “Farm-to-Table” movement is popular, but there was no such trend when The Center launched its Seed-to-Belly® initiative more than three decades ago. In the 1980s, it was unheard of for a school and residence for children and adults with medical frailties and complex disabilities to embrace a goal of self-sufficiency in organic food production. But through its commitment to the land and its people, The Center has found that less processed, nutrient-dense whole food greatly contributes to the overall health of its students and residents.

For example, the Centers for Disease Control has noted high rates of obesity among adolescents with developmental disabilities, with the highest rate of 31.8 percent found for children with ASD. By comparison, the rate of obesity for adolescents at TCFD is 5.95 percent.

Children and adults with complex disabilities, medical frailties, and Autism Spectrum Disorders are more susceptible to triggers in their environment than people without these conditions. Some of these triggers relate to the design of the built environment—the amount of noise, natural light, ventilation, flooring, and size of spaces. Other triggers are chemicals that can be found in food, building materials, cleaning supplies, and many other products. For more than 30 years, TCFD has been committed to innovative thinking about complex health issues and designing thoughtful solutions to those problems.
A building is not just a building at The Center for Discovery—it has the power to affect a person's health and happiness. The Center was an early proponent of Leadership in Energy and Environmental Design (LEED) certification, because LEED emphasizes the use of building materials that do not emit toxic chemicals, as well as sustainable energy and design techniques. LEED-certified buildings avoid paints, adhesives, and finishes with volatile organic compounds (VOCs), and vinyl floorings with phthalate, among other requirements.

TCFD boasts one of the earliest LEED-certified healthcare buildings in the country, the Discovery Health Center, and The Center’s Michael Ritchie Big Barn Center for Environmental Health and Education is Platinum LEED certified. The Big Barn features geothermal heating and cooling, a large photovoltaic array, recycled wood, and a robust building envelope that uses environmentally friendly insulation. The facility hosts special events, activities, and research operations.

The Center for Discovery’s reputation is such that when the award-winning Michael Singer Studio embarked on an “Autism Design” project to create housing for adults with Autism Spectrum Disorders, it engaged TCFD for its expertise with ASD and the built environment. The project, funded by the Jeffrey Cook Charitable Trust, used sustainable practices to design housing that provided a positive space for adults with ASD.

The Michael Ritchie Big Barn Center for Environmental Health, Education and Research

### Platinum LEED Certification Matrix

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<td>The Michael Ritchie Big Barn Center was designed to minimize its environmental footprint. Pollution is reduced by providing access to bicycle pathways and secure bicycle storage areas, and by facilitating the use of alternative-fuel vehicles and public transportation. Roofing materials have a high solar reflective index value, which minimizes or eliminates the impacts of high temperatures caused by darker roofing materials and minimizes cooling costs and impacts.</td>
<td>Landscaping around the project is climate-tolerant with the ability to thrive on natural rainfall quantities. Gutter systems direct rainwater runoff throughout the site to give vegetation an additional water supply. Water conserving elements such as dual functioning toilets and automatic sensor faucets are implemented throughout the buildings.</td>
<td>Energy performance is optimized with the implementation of a solid building envelope, efficient mechanical systems, reduced demand, recovery of waste energy, and the harvest of free site energy via a photovoltaic system. Onsite renewable energy is provided by photovoltaic panels and a geothermal heating and cooling system.</td>
<td>Low-emitting adhesives, paints, carpet systems, and composite woods allow for a cleaner indoor air quality. Lighting control systems enable adjustments to suit individual task needs and preferences. The robust insulation package keeps heating and cooling costs down and maintains more consistent and comfortable temperatures for occupants.</td>
<td>The public is regularly educated about the techniques and systems implemented throughout the buildings by the use of literature, signage, and tours. The irrigation system is uniquely tied into the geothermal loop system in order to get maximum use of available water sources.</td>
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When the market didn’t provide adequate access to mobility for all TCFD students and residents, TCFD developed its own technology to enable mobility for all.

TCFD has a large number of students and residents in wheelchairs—particularly those who cannot push the wheelchairs themselves or who cannot drive power-assisted wheelchairs due to cognitive impairment. However, mobility is a critical factor in cognitive development, and self-generated mobility is important across all types of development: physical, emotional, cognitive, and social. The problem faced by physical therapists at The Center for Discovery was how to find power chairs that fit the unique needs of The Center’s children and adults.

Standard power-assisted wheelchairs lack the capacity to customize seating for individuals with scoliosis, or are not helpful for individuals who lack the fine motor skills needed to control a joystick. Therefore, the goal was to develop a universal device that turns an existing manual chair, with all its individually customized features, into a power chair. The universal device enables a TCFD student or resident to advance onto the rolling base of the device while sitting in their manual wheelchair. The device then provides power and different ways to steer the now power-assisted wheelchair—e.g., an array of switches mounted on the head rest that enables wheelchair movement to the right if the individual looks right, or a toggle or large button that an individual can swat with his or her hand to stop and go.

The mission of indieGo—to improve mobility for anyone, anywhere—speaks to the philosophy, the commitment, and the creativity of The Center for Discovery and its staff. The TCFD physical therapist who had the original idea for indieGo made three prototypes with TCFD’s assistive technology department. The first weighed 300 pounds and could not fit through a doorway. Yet, functionally it was successful enough to convince the team to push forward with refinements that reduced the device’s cumbersome weight and size.
After developing the third prototype, the team applied to the Google Impact Challenge: Disabilities grant program and in 2016, Google awarded TCFD with a $1.125 million grant to commercialize the indieGo technology. indieGo has a “production-ready” prototype and is currently undergoing final testing and value engineering while the TCFD innovation team begins meeting with prospective customers and investors.

The impact of giving mobility to people who have never experienced mobility before is powerful. TCFD Director of Innovation Jason Kean said, “indieGo is a means of facilitating greater mobility for everyone, so that they can experience their environment under their own volition. At The Center, we see kids who had never participated in movement activities becoming more engaged and more curious about the world around them after experiencing independent mobility through indieGo.”

A TALE OF THREE PROTOTYPES

**Custom Postural Seat**

**CHALLENGE:**
Create a customized postural seat for a young adult, specifically for use during therapy

**INNOVATION TEAM:**
Physical therapist, assistive technologist, staff, HML staff.

**IMPACT:**
Make 3D scans of the individuals’ unique physiology and produce a succession of customized postural seats in pace with the evolving demands of therapy. The custom seats derive from the unique 3D scans and are milled out of memory foam utilizing a CNC router.

**Tea Bag Holder**

**CHALLENGE:**
Help individuals working in The Center’s Day Habilitation program to position and fill empty tea bags during packaging. Previously, this task often required the assistance of staff to minimize lost product.

**INNOVATION TEAM:**
assistive technologist, staff, HML staff.

**IMPACT:**
Building on a one-off design, designed a tea bag holding system to the exact dimensions of the materials in 3D software, then 3D-printed the system to scale. The system can now be easily modified and quickly reproduced to add work stations.

**3D Speech Icons**

**CHALLENGE:**
Enhance communication for students with visual impairments

**INNOVATION TEAM:**
Speech therapist, assistive technology staff, HML staff

**IMPACT:**
Utilize open-source 3D files to develop, customize, and 3D-print speech icons for individualized use.
THE CENTER FOR DISCOVERY’S INNOVATION PROCESS

As innovation activity has grown over time, The Center is beginning to formalize its innovation process, which includes these key components depicted in the figure below:

1. **Identify**: Encourage educators and clinicians to identify important problems and suggest novel solutions for addressing them;

2. **Define**: Work with a rehabilitative or assistive technology staff member to better define the problem and the parameters of the pilot concept;

3. **Prototype**: If the concept meets certain criteria, then it is “green-lighted” for prototyping and a team is formed to champion this project;

4. **Validate**: The initial prototype will be validated to assess how the prototype holds up in practice; innovation is an iterative process, and the define-prototype-validate process may occur multiple times as technical issues are worked through;

5. **Optimize**: Once a prototype is developed that is validated in terms of being the correct technical solution for an end user, the team will shift emphasis to optimize the technical solution in terms of cost and technical fine tuning;

6. **Bring-to-Market**: Implement for use within TCFD Programming and identify opportunities for commercialization.15
The Center for Discovery has generated more than a billion dollars of economic activity for the State of New York since 2010.

Growing from 25 employees in 1980 to 1,560 employees in 2016, The Center is Sullivan County’s largest private sector employer. The average compensation (wages and benefits) for TCFD employees of $49,449 is 33 percent higher than the county’s private sector average of $37,121. The Center also maintains an office in New York City.

Over the last seven years, The Center for Discovery has generated $1.075 billion of economic impact for the State of New York. In 2016, The Center directly employed 1,560 people, and it had total operating expenditures of $103.8 million (including real estate purchases of $1.1 million). The Center’s total economic impact is even larger when the combined effect of TCFD’s operations and employment (and employee spending) on other local and regional business are factored in—especially since 79 percent of TCFD employees reside in Sullivan County. TEConomy estimates that TCFD generated $193.1 million of economic activity for the State of New York in 2016 through total direct, indirect, and induced impact; supported 2,119 jobs with $111.9 million in compensation; and accounted for $9.9 million in state and local tax revenue. While TCFD’s tax revenues are generated primarily through payroll and personal income taxes, in 2016, $198,374 represented direct property taxes paid on renovated buildings that TCFD leases to local private businesses.
Table 1 The Center for Discovery's Total Impact on the State of New York, 2016

<table>
<thead>
<tr>
<th>Impact Type</th>
<th>Employment</th>
<th>Labor Income</th>
<th>Output</th>
<th>State/Local Tax Revenue</th>
<th>Federal Tax Revenue</th>
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<tbody>
<tr>
<td>Direct Effect</td>
<td>1,560</td>
<td>$77,140,272</td>
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Table 2 The Center for Discovery's Economic Impact on Sullivan County, 2016

<table>
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<th>Output</th>
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These data are summarized in Table 1 for New York State and Table 2 for Sullivan County (with further explanation on the impact categories and methodology used provided in the Appendix).

In the same way that the expansion of universities and academic medical centers have helped revitalize declining cities in the Rust Belt, such as Cleveland and Pittsburgh, TCFD's direct employment and business effects have been a positive force for change in Sullivan County. Like these cities, the county has suffered from a declining population, lower than average incomes, a relatively high poverty rate, and a downtick...
in new jobs creation (that pay livable wages). These factors make TCFD’s impact on the community even more significant.

Historically (1880-1940) a prosperous center for dairy farming, this southern part of the Catskills region supplied milk and cheese to New York City via rail. Then in the 1920s through 1960s, Sullivan County benefited from the Catskills’ resort heyday, but even at its peak, this seasonal tourism model brought uneven economic opportunities to the region. Nevertheless, when the decline of the tourism industry followed the decline of the dairy industry, the region suffered a significant economic blow that has had long-lasting negative impacts on residents. Moving into the 1980s, Sullivan County was sorely in need of an economic catalyst for change.

In 1948, TCFD opened as United Cerebral Palsy of Sullivan County. The current CEO, Patrick H. Dollard, took the helm in June of 1980. Over the years, his vision has transformed the organization’s focus from one of disability to one of possibility and personal potential. United Cerebral Palsy of Sullivan County became The Center for Discovery, breaking with the status quo of disability care prevalent at the time using data, careful observation, and a comprehensive, evidence-based approach to address the many challenges faced by The Center’s students and residents.

“The old way of disability-centric thinking had no notion of moving toward an outcome,” Mr. Dollard said. “We’ve started a revolution in care by focusing on each person’s abilities, and helping them build a better, more meaningful life. Our strategy translates to all people and all communities, and you can see how our work in creating more meaningful lives is enriching—mentally, physically and economically—the communities around us.”

Today, The Center is one of New York State’s Centers of Excellence in the Care and Treatment of Children with Complex Disabilities. It develops and models many best practices in the education and care of children and adults with Autism Spectrum Disorders and complex disabilities, and like other leading research centers, partners with top researchers across the country. Each year The Center attracts and hosts approximately 150 interns and professionals for both short-term and long-term stays. They include
medical residents; educators; physical and occupational therapists; chefs and nutritionists; music, dance and art interns; and biodynamic farming interns, among others.

Another important focus of The Center is the built environment, because of the impact that the physical environment has on students’ and residents’ learning and health outcomes. This focus extends from the design of TCFD’s schools and residences to the universal design elements that facilitate access to the outdoors across the campus and in town. The Center has been visionary in developing school campus environments that foster connections to food, to the land, to animals, to nature, and to the creative arts for students and residents.

This visionary outlook is also evidenced in the critically important leadership role that TCFD is playing in the broader community. Through its private and public partnerships and investments, TCFD is seeking to advance regional quality of life and job opportunities centered around three core economic development goals:

1. Strengthen the region’s business attraction and recruitment efforts by expanding the number of cultural, creative, and recreational amenities;

2. Serve as a direct economic catalyst by purchasing abandoned buildings in downtown Hurleyville, renovating them, and leasing them to private businesses; and

3. Improve the health and quality of life for Sullivan County residents through its investments in the built environment.

Totaling nearly $130 million over the past 30 years, the scale of The Center’s investments throughout the region is significant, as shown in the figure below. These investments include the construction and renovation of buildings and residences on The Center’s Main Campus in Harris; The Center’s Sweet Hill Farm and residence in Grahamsville; and The Center’s campus, offices and residences, the Rail Trail, and Main Street redevelopment in Hurleyville.

The Center for Discovery has raised $37.6 million in private funding from 2011 to 2016. These funds have supported The Center’s revitalization projects in neighboring towns and hamlets and are used to support TCFD research and innovation activities, agricultural programs, and creative arts programs, such as Music Therapy and Dance Therapy.
As these investments breathe new life into the region, outside investors are taking an interest.

“The Center’s investment in the health and economy of Fallsburg has changed the socio-economic dynamic in our community for the better,” said Steve Vegliante, the Town of Fallsburg Supervisor. “Real estate prices are rising, private investment is growing exponentially, and we are seeing our area redevelop into a vibrant community.”

For example, a $90 million Ayurvedic spa, resort, yoga, and wellness center is currently under construction just a few miles from Hurleyville. Smaller in size, yet equally important from an economic diversification perspective, two manufacturing facilities are also opening in Sullivan County: Metcar and Sullivan County Fabrication. Metcar, a precision parts manufacturer for the aerospace industry, is opening a facility in Glen Wild; and Sullivan County Fabrication, a manufacturer of shelves and replacement parts.

### The Hurleyville Maker’s Lab

The Maker Movement is a grassroots movement and culture that seeks to revive the American spirit of learning-by-doing, and designing and creating physical things. At its core, the Maker Movement’s philosophy espouses the idea that “Making is fundamental to what it means to be human… [The physical things that people create] are like little pieces of us and seem to embody portions of our souls.”

The Maker Movement has taken off across the country due to the creation of makerspaces that:

1. Make design and fabrication equipment and tools accessible to everyone;
2. Employ technical staff and develop a community of makers that help each other; and
3. Give makers in the community a physical place to come together to create and exchange ideas.

Because makerspaces require significant upfront and ongoing operational investments, they tend to be located in large, urban areas. The creation of a Maker’s Lab in Hurleyville is a particularly forward-looking investment that can support longer-term economic development objectives. Innovative partnerships with local school districts, businesses, investors, organizations and others will be key to the Maker’s Lab success. Commentators on makerspaces, such as The Brookings Institution, have noted that makerspaces are being recognized in many communities for helping people move from operating at an artisanal and hobby scale to an entrepreneurial and business scale.
parts for supermarket cases and equipment, is expanding to a new location just outside Woodridge.

Over the last 15 years, Sullivan County’s manufacturing employment has grown by 57.5%, albeit from a small base (956 employees in 2001 to 1,506 employees in 2015). Today, manufacturing is Sullivan County’s fifth largest industry sector measured by employment. By contrast, manufacturing employment in the State of New York fell by 35.3% over the same 15-year period. TCFD’s investment in the Hurleyville Maker’s Lab complements this expanding industry base since continuous innovation—both incremental improvements to existing products and manufacturing processes, as well as the introduction of new products—have been shown to contribute strongly to the long-term competitiveness and profitability of small manufacturers.
The Re-Imagining of Downtown Hurleyville

Hurleyville is a small hamlet of a few hundred people located along the old O&W Railway within the Town of Fallsburg. It is a short distance from The Center for Discovery's main campus in Harris, and the site of The Center's 300-acre biodynamic farm, Stonewall Preserve. As part of its larger vision and commitment to creating a pedestrian-friendly, economically viable community for its students, residents, employees, and neighbors, TCFD has invested $9.0 million to revitalize Hurleyville's downtown over the last decade.

In addition to redeveloping a dormant farming operation and erecting a number of new buildings, TCFD has purchased abandoned and run-down structures, renovated them, and either leased them to private businesses or used them to house creative arts, industrial arts and prototyping, and other amenities that are open to the public. As a result of this new development, The Center has reinvigorated the downtown with new things to do, new ways to connect, and new creative outlets and learning opportunities.

The Center was a key player in obtaining funding for the reconstruction of the sidewalks along Main Street in Hurleyville. The $350,000 phase one of the project, reconstructing the sidewalks along the east side of the street, is complete, and the $400,000 phase two, which will address the opposite side of Main Street, should be complete by fall of 2018.

Some other examples of TCFD's major initiatives and investments over the last decade include:

- Revitalizing downtown Hurleyville's Main Street through development and management of the Hurleyville Market, the Hurleyville Arts Centre (a center that includes a 140-seat cinema, dance studio, and performance area), and the Hurleyville Maker's Lab (a makerspace with design and fabrication equipment, open to the public);

- Using donations from private benefactors who share its vision to purchase abandoned and run-down buildings, refurbish them, and lease them to local businesses such as the Pickled Owl gastropub and Pinwheels fabric store; and

- Building partnerships to expand outdoor recreational opportunities such as the paving of the 9-mile O&W Rail Trail (See “The Rail Trail: Public Parks as an Engine for Economic Development”) and development of a bike lane connecting the SUNY Sullivan campus to downtown Hurleyville.

The Center's investments and public-private initiatives provide a model for how prominent institutions can play a catalytic role in redeveloping economically distressed communities. By striving to create a more vibrant community characterized by live/work/play elements, The Center has helped develop a flow of new ideas and new energy, and productive connections outside the region.
As Hurleyville grows, The Center and SUNY Sullivan, a college campus just over one mile from the center of the hamlet, are seeking to build ties between the college and community—putting the “community” back in community college. A more vibrant town will be a huge boon to both the college and the town, helping to draw more students to seek admittance to SUNY Sullivan and further enlivening the hamlet. Continued investment in Hurleyville has the potential to bring many more benefits to the surrounding town and region.

**Hurleyville Maker’s Lab:**
$2.5M renovation of a vacant warehouse

**Hurleyville Arts Centre:**
$6.5M renovation of a vacant restaurant that had succumbed to a fire

**Fiber on Main:** $0.5M renovation of a vacant building
In 2012, The Center for Discovery partnered with the Open Space Institute (OSI), a New York-based conservation organization dedicated to preserving scenic, natural, and historic landscapes for public enjoyment, to purchase a 9.2-mile section of abandoned Ontario & Western Railway right-of-way to develop a universally accessible public rail trail.

The Center envisioned a trail that would be fully accessible to all, no matter age, disability or level of fitness, and bring recreational and tourism opportunities to the whole community. With the trailhead located in the heart of downtown Hurleyville, the presence of the rail trail sets the tone for the hamlet, encouraging locals to get outside and enjoy the beauty of their community, as well as drawing in visitors from all over the region. The project is a success story of bringing together public and private partners who want to invest in a community’s future.

“The idea of partnering with OSI to develop something that will benefit everyone in the community and will spur economic activity for the entire community is incredibly important to us,” The Center for Discovery CEO Patrick H. Dollard said. “We want to be sure that our surrounding communities offer opportunities that the individuals in our programs can utilize, but also provide resources for our staff to take advantage of as well as our friends and neighbors. It’s critical to our business model to be a good neighbor and enhance our community.”

To guarantee that the newly named Hurleyville Milk Train Trail is available to the whole community, The Center leased the rail bed to the Town of Fallsburg for $1 a year. The town obtained a $1.27 million grant from the New York State Department of Transportation for the first stage of improvement: paving a section of the trail that follows the rail bed for three miles from the approximate center.
of the hamlet of Hurleyville, out in opposing directions. This initial paving project has made these sections of the trail fully accessible to cyclists, pedestrians, and visitors with mobility challenges, and eventually, paving of further trail sections is planned. Meanwhile, The Center has also invested in the development of other amenities, such as basketball and pickleball courts, and the rehabilitation of buildings near the trailhead for local businesses to move into this section of the downtown. The Pickled Owl gastropub has located in one of these renovated buildings next to the trailhead. The Center is also developing a plan to provide adapted bicycles to children and adults in wheelchairs so they can accompany family and friends on rail trail cycling trips.

Linked with other trail sections in Sullivan County, the new Hurleyville Milk Train Trail will create more than 25 miles of improved pathways for public use, with the ultimate vision of connecting with the growing network of rail trails throughout the Catskills and Hudson Valley, stretching to the Walkway Over The Hudson and beyond into Duchess County.

Like the High Line in New York City, the overarching goal for the Milk Train Trail is that it will become a popular destination unto itself, drawing visitors, attracting businesses, and spurring follow-on investments in the county and the region.

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**The Economic Impact of New York City’s High Line**

New York City’s High Line Park is “a unique ribbon of parkland and civic amenities winding through the city, built on a refurbished, elevated rail line dating from the 1930s that had long been scheduled for demolition.” The eight-year, $273 million, 1.5-mile public park has become one of New York’s most popular cultural attractions, drawing some five million visitors each year. The Friends of the High Line, a non-profit organization, lobbied the city for the rail line’s preservation and development, estimating that locating an elevated park in Manhattan’s Lower West Side in Chelsea would boost the city’s tax revenues by $250 million over 20 years due to increased local real estate values and would also attract an estimated 400,000 tourists a year. The latest figures on tax revenue and visitors far surpass advocates’ expectations. Since the park opened in 2009, over 30 new residential, commercial, and cultural development projects have been planned or constructed in the area. These projects have increased tax revenue by $980 million per year and generated economic activity of $2.2 billion. The Wall Street Journal refers to this as the High Line’s “Halo Effect” on property.
The Center for Discovery aspires to drive even greater long-term social and economic impacts, far into the future, through its applied research and innovation.

Several major initiatives are underway to further elevate the standard of complex care, improve both individual and community health outcomes, and significantly benefit the local and regional economy.

Specialty Hospital
The Center for Discovery’s innovative Children’s Specialty Hospital will provide specialized, short-term hospital care for New York State children with significant physical disabilities and complex autism, as well as support and training for their family, caregivers, and school districts. The Specialty Hospital’s intense, integrated assessment and individualized treatment, coupled with the development of effective strategies that can be feasibly carried out at home or in school, will enable each child to successfully live in the least restrictive setting, and prevent or significantly delay long-term residential placement or hospital stays. The hospital is expected to save New York State millions of dollars each year, and the goal is for it to be replicated throughout the state and beyond.

Research Institute: Subtyping Autism and more
In partnership with researchers and scientists from major universities, TCFD’s interdisciplinary Research Institute is undertaking pioneering studies designed to improve and
empirically validate a variety of supports for individuals with Autism Spectrum Disorders, complex medical frailties and many related health issues.

TCFD is now in the highly unique position to begin to subtype autism, determining whether: (1) specific comorbidities group together in the same individuals; and, (2) noninvasive psychophysiological markers of the stress response correlate to subsets of individuals with specific behaviors and comorbidities. This work will lead to more accurate and cost-efficient diagnosis and treatment of individuals with autism, and the automated tool and algorithms the TCFD team is developing could have a transformative and direct impact on a variety of other complex diseases and disorders, including Alzheimer’s disease and dementia.

In addition to this research, TCFD has partnered with the world’s leading experts in drug-resistant epilepsy and drug safety to conduct an observational trial related to the use of medical marijuana. This trial, aimed at better understanding the type and dosage of medical marijuana to potentially improve seizure control, while also ensuring the health and safety of the individual, is expected to inform state and clinical guidelines for the use of medical marijuana.

Just the beginning
The Center for Discovery already makes a meaningful impact on the lives of people with complex disabilities, the world of education and healthcare, and the economy, but its plans are far from over. Expansion is planned for TCFD’s education program, therapeutic innovations, and career development and engagement initiatives, including employee housing. TCFD is also expanding its clinical services and facilities to provide essential health services across the region, including several planned extension clinics and the development of a comprehensive sleep lab for the testing, diagnosis, treatment, and long-term care management of sleep disorders. In the coming years, The Center for Discovery will work to continue making transformative impacts and secure its role as one of the foremost leaders in education and health.
ABOUT THIS STUDY

This study was undertaken by TEConomy Partners, LLC, on behalf of The Center for Discovery. It updates a previous economic impact study that was conducted in 2011 and extends it by including analysis of TCFD’s core functional impacts. The base year of analysis for this study is 2016.

The study quantifies TCFD’s direct economic impact on the State of New York, and also examines how The Center’s pursuit of its educational and clinical care mission, its research and innovation activities, and its strategic investments alongside public and private partners are contributing to the vibrancy and revitalization of this region in the Catskills, 90 minutes northwest of New York City.

TEConomy Partners, LLC (TEConomy) is a global leader in research, analysis, and strategy. Our clients comprise universities, governments, industry, and non-profit institutions, who all share a common need to understand and navigate the innovation economy despite their diverse objectives. We have performed economic impact analyses for the Human Genome Project, the Mayo Clinic, the University of Pittsburgh Medical Center, the North Carolina Biotech Center, and many other universities and academic medical centers. This study was led by Jennifer Ozawa, Simon Tripp and Marty Grueber at TEConomy.

METHODOLOGY

To assess The Center for Discovery’s functional and economic impacts, TEConomy Partners used a mix of qualitative and quantitative approaches. For the functional impact analysis, data and information came from direct interviews with approximately 20 TCFD staff representing operations, finance, school administration, adult program administration, research, innovation, and farming operations; current and former Sullivan County and Town of Fallsburg officials; and the Sullivan County Industrial Development Agency. TEConomy also conducted secondary research on each of the functional impact topics.

For the economic impact analysis, TEConomy worked with the Chief Financial Officer to collect calendar year 2016 data on direct employment, payroll, and operating expenditures. The remainder of this section describes and defines economic impact analysis, why it is useful as a conceptual framework, and how TEConomy performed their analysis.

Driven by internal and external factors that impact overall levels of consumption, production, investment, government spending, and net exports, regional economies expand and contract over time. Economic impact analysis seeks to estimate how the economic activity generated through the expansion or contraction of a particular economic actor, or through a particular investment, impacts the local and regional economy.

For example, studies have been conducted that measure the economic impact of a university expansion on a regional economy, or conversely; the economic impact of the decline of a
manufacturing industry. TEConomy’s study builds on this body of work to measure the “eco-
nomic footprint” of The Center for Discovery on Sullivan County and on the State of New York.

Using an economic input-output (I/O) model, TEConomy analyzed the relationships between 
TCFD and other actors in the regional and state economy. These relationships are linked via 
expenditures. The combined effect of TCFD’s direct employment (personal spending) and 
operational expenditures (business spending) generates demand for goods and services from 
other local and regional businesses.

In general, higher-wage industry sectors will generate more economic activity (through 
higher personal incomes and larger personal consumption expenditures) than lower-wage 
industry sectors. This means that the expansion of companies in high-tech or more knowl-
dge-based sectors will tend to have a larger economic impact than, say, new retail activity. 
Similarly, an industry’s purchases of goods and services from within the region will result in 
more economic activity by stimulating local demand, while imports of goods and services 
from outside the region will result in less regional economic activity.

Economic impact or I/O models measure three types of impacts:

- **Direct effects**: the direct employment and other economic activity generated by a firm or 
  industry sector’s operations and expenditures;

- **Indirect effects**: the economic activity generated for supplier firms by the target firm or 
  industry sector, and

- **Induced effects**: the additional economic activity generated through the spending of 
  wages by the direct employees and the employees of the supplier firms in the overall 
  economy.

The sum of these three effects is referred to as total economic impact and measures the total 
flow of economic activity in the region stemming from the activities of the particular eco-
nomic actor, in this instance, TCFD. TEConomy estimated the total economic impact of TCFD 
using regional I/O models available from IMPLAN. IMPLAN is one of the most widely used 
and respected I/O software platforms and provides highly detailed data tables representing 
536 economic sectors at the national, state, and county levels.
APPENDIX: ECONOMIC IMPACT TABLES

Three direct operational inputs are used to drive the economic interactions within the impact models: employment, total compensation (including wages, benefits, and other compensation), and total operating expenditures.

For each operational component, TEConomy’s data analysis and calculations provide estimates of the following types of economic impacts, or effects:

- **Direct-effect** values driving the model that are based upon the employment, compensation, and expenditure data provided by The Center for Discovery and/or estimated by TEConomy and The Center for Discovery staff.
- Estimated **indirect and induced effects** capturing the secondary and tertiary effects of TCFD-based employment and expenditures on the regional economy; and
- **Total impacts**, which is the sum of the direct, indirect, and induced effects.

These different types of impact effects are presented for five impact metrics: (1) employment, (2) labor income (compensation including both personal and proprietor income), (3) economic output (revenue or the dollar value of production), (4) state and local tax revenue, and (5) federal tax revenue (including employer and employee contributions to Social Security and Medicare). The tax revenues are adjusted, to the extent practicable, to account for TCFD’s non-profit status.

For the three non-tax revenue metrics, an impact multiplier is also calculated. These multipliers capture the total number of jobs or dollars created in the regional economy for every job or dollar of direct effect occurring within The Center for Discovery. For example, an employment multiplier of 1.30 would indicate for every 1 direct job at The Center for Discovery, an additional 0.30 indirect and induced jobs are supported in the region’s economy.

The following tables present TEConomy’s estimates of The Center’s economic impacts on Sullivan County and on the State of New York. Note that real estate purchases, in this instance valued at $1.1 million in 2016 for TCFD, are a simple transfer of wealth, and are therefore not included in the operational expenditures for impact modeling purposes as represented by the Direct Effect of $102.7 million in Output.

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<td><strong>Indirect Effect</strong></td>
<td>151</td>
<td>$4,631,187</td>
<td>$14,918,126</td>
<td>$1,270,459</td>
<td>$1,221,987</td>
</tr>
<tr>
<td><strong>Induced Effect</strong></td>
<td>308</td>
<td>$10,918,466</td>
<td>$40,084,265</td>
<td>$3,494,232</td>
<td>$3,087,773</td>
</tr>
<tr>
<td><strong>Total Impacts</strong></td>
<td>2,019</td>
<td>$92,689,925</td>
<td>$157,659,783</td>
<td>$7,971,663</td>
<td>$20,833,845</td>
</tr>
<tr>
<td><strong>Multiplier</strong></td>
<td>1.29</td>
<td>1.20</td>
<td>1.54</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: TEConomy Partners analysis and calculations using Sullivan County-level IMPLAN model.
Table 2: The Center for Discovery’s Total Impact on the State of New York, 2016

<table>
<thead>
<tr>
<th>Impact Type</th>
<th>Employment</th>
<th>Labor Income</th>
<th>Output</th>
<th>State/Local Tax Revenue</th>
<th>Federal Tax Revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Effect</td>
<td>1,560</td>
<td>$77,140,272</td>
<td>$102,657,392</td>
<td>$3,559,482</td>
<td>$15,540,274</td>
</tr>
<tr>
<td>Indirect Effect</td>
<td>163</td>
<td>$11,340,188</td>
<td>$27,177,238</td>
<td>$1,688,966</td>
<td>$2,916,507</td>
</tr>
<tr>
<td>Induced Effect</td>
<td>396</td>
<td>$23,461,055</td>
<td>$63,263,823</td>
<td>$4,663,285</td>
<td>$5,980,345</td>
</tr>
<tr>
<td>Total Impacts</td>
<td>2,119</td>
<td>$111,941,515</td>
<td>$193,098,453</td>
<td>$9,911,733</td>
<td>$24,437,126</td>
</tr>
<tr>
<td>Multiplier</td>
<td>1.36</td>
<td>1.45</td>
<td>1.88</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: TEConomy Partners analysis and calculations using New York State IMPLAN model.
END NOTES

1. TEConomy Partners estimated TCFD’s total economic impact for each year from 2010-2016 using employment and operating expenditures data from 990 tax filings.


14. The Center for Discovery.

15. The definition of “innovation” is the introduction of a new or significantly improved product or service to the market. Organization for Economic Co-operation and Development (2005), Oslo Manual. Guidelines for Collecting and Interpreting Innovation Data, 3rd Edition.