DELTA 8.7

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TECH AGAINST TRAFFICKING

ASU Global Security Initiative
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CODE 8.7: CONFERENCE REPORT

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About Code 8.7

The Code 8.7 conference, organized by Delta 8.7, The Alan Turing Institute, the Computing Community Consortium, Tech Against Trafficking, the Rights Lab and the Global Security Initiative at Arizona State University, brought together the artificial intelligence, machine learning, computational science and anti-slavery communities for the first time in February 2019. Over two days, more than 30 speakers and 120 participants discussed how these technologies could be used to help in the fight to eradicate forced labour, modern slavery, human trafficking and child labour in line with Target 8.7 of the Sustainable Development Goals.

The event examined the value of machine learning to the anti-slavery community, how best to combine Big Data and Small Data, the possibilities of information and communications technology (ICT) for survivor self-identification and the roles of satellite remote sensing, crowd-computing and open digital maps to better visualize slavery locations. Throughout the two days of plenary sessions and hothouses, there were conversations around the biases found in data, the need to understand modern slavery prevalence, how to use financial data to identify trafficking and the role of survivors as subjects and researchers.

More information about the event, including videos and speaker presentations, can be found on the Code 8.7 page. [1]

[1] Visit https://delta87.org/code87/

VULNERABILITY MAPPING AND MODELLING

Todd Landman
Professor of Political Science and Pro Vice Chancellor of the Faculty of Social Sciences, University of Nottingham

The Code 8.7 showcase panels, plenary sessions and mini-hothouses had a number of common themes in addressing how and in what ways computational science and artificial intelligence (AI) can help the fight against modern slavery. Across the two days of the conference, there was much discussion about the hidden nature of the phenomenon of modern slavery and from a scientific perspective, the fundamental problem of "unobservability". Slavery is akin to other human rights violations in that agents and perpetrators are differently motivated, victims and survivors are hard to find, and acts of commission and omission that lead to increased vulnerability and actual instances of modern slavery are difficult to document and analyse.

Computational science and AI offer partial solutions to these problems by using direct and indirect observations that are known about modern slavery to provide inferences on and insights into activities, people and trends that are as yet unknown. Like other social scientific research, such an evidence-inference methodological core sits at the heart of any solution offered by the myriad of ways computational science and AI can provide additional explanation and understanding to the problem, including mapping vulnerability to slavery, prevalence of slavery, roots causes of slavery, liberation of victims and prosecution of perpetrators.

Across the presentations and discussions there was an underlying need for clarity about how anti-slavery organizations, government agencies, academics and technology companies think about operationalizing modern slavery for careful and systematic analysis. One useful framework comes from Adcock and Collier,[2] the elements of which help address many of the problems and issues raised at the conference, and which has been used previously in work on measuring human rights.[3] The framework has four main elements:

- background concept;
- systematized concept;
- indicators; and
- scores on units.

Background concept: Modern slavery is a concept that is not uncontested, but one for which there is an emerging consensus that has mobilized academics, government agencies, anti-slavery organizations as well as technology and other private-sector companies, who were all represented at Code 8.7. Moreover, Target 8.7 of the Sustainable Development Goals itself is evidence of the global recognition of the problem and commitment to find effective ways to end slavery by 2030.

Systematized concept: The main meaning and core content of what constitutes modern slavery, including its different attributes and dimensions needs to be systematized using international law, international human rights law and the Bellagio-Harvard Guidelines on the Legal Parameters of Slavery.[4] More work is required on using these legal frameworks to delineate a set of core attributes of modern slavery.

[2] Robert Adcock and David Collier, "Measurement Validity: A Shared Standard for Qualitative and Quantitative Research", *American Political Science Review*, vol. 95, No. 3 (September 2001).

[3] Todd Landman and Edzia Carvalho, *Measuring Human Rights* (Oxford, Routledge, 2010).

[4] The Research Network on the Legal Parameters of Slavery, "Bellagio-Harvard Guidelines on the Legal Parameters of Slavery" (March 2012).

Indicators: The attributes and main dimensions of slavery can be operationalized using direct and indirect measures. Direct measures include acts, decisions, violations, cases, victims and perpetrators involved in modern slavery. Indirect measures include perceptions, feelings, physical objects (e.g. brick kilns), behaviours, financial transactions, community practices, and cultures and larger sets of structural factors related to the increased vulnerability and probability of individuals falling into conditions of slavery (see also the 'determinants of vulnerability' model from the International Organization for Migration).[5]

Scores on units: The actual data generated through application of the indicators to observations across different units of analysis included:

- *Events-based data,* such as the 91,000 case management data presented by Harry Cook from IOM;
- *Standards-based data,* such as the Cingranelli and Richards country-level data on the protection of worker rights and the Government Response Data from the Walk Free Foundation;
- *Survey-based data,* such as individual level data on child labour in Latin America presented by Maria Salvo from the ILO and the Global Slavery Index from the Walk Free Foundation;
- *Socio-economic and administrative statistics;* and
- *Big data,* such as the work on vulnerability mapping in Tanzania presented by James Goulding from the Rights Lab and the geospatial analysis of brick kilns using satellite imagery presented by Doreen Boyd from the Rights Lab.

Computational science and AI are predicated on strong theoretical and conceptual foundations that are then used to make initial observations necessary for training and developing algorithms for processing, predictive analytics and inferential statistics applied to large-scale structured and unstructured data. Combining such forms of analysis across different data streams and data types allows for more complete and robust pictures of the direct and indirect indicators of modern slavery.

The work on Tanzania does not measure slavery per se, but it does provide insights into the geographical probabilities of slavery based on varying degrees of vulnerability to slavery. The work on the brick kilns in South Asia does not measure actual incidents of slavery from space, but instead estimates the total number of physical sites where there is a high probability of slavery occurring.

These two examples make the larger point, which was reinforced across other sessions at Code 8.7, that computational science and AI alone are not sufficient for combatting slavery, but that the insights that these methods of analysis provide reveal many of the unobserved and hidden elements of modern slavery that then assist advocates, prosecutors, NGOs and other stakeholders to design and implement purposeful interventions to reduce and/or eliminate enslavement.

[5] International Organization for Migration, *IOM Handbook: Protection and Assistance for Migrants Vulnerable to Violence, Exploitation and Abuse* (Geneva, 2018).

USING ICT TO FIND HIDDEN POPULATIONS

Zoe Trodd
Director of the Rights Lab, University of Nottingham

The modern anti-slavery movement began in the late 1990s and slowly achieved policy acceptance, contributing to the refinement of legal definitions and opening the door to numerous activist groups that were largely unguided by research.[6] The unsophisticated analyses used during the growth of this movement over the past 15 years did little to achieve the goal of ending slavery.

Today, evidence-led groups are coming to the fore as the global community works towards Target 8.7. The Code 8.7 conference took up the question of what computational science and artificial intelligence can contribute to the delivery of those "effective measures".

At the ICT hothouse, speakers Shannon Stewart from GFEMS, Sam Blazek from IST Research and Hannah Thinyane from UNU-CS introduced a range of stand-alone and interconnected methods, including network scale-up, longitudinal migration tracking, predictive modelling, dark web analysis and survivor-deployed apps. These technologies can be used to advance fast prevalence estimation, tackle slavery in apparel supply chains, disrupt trafficking networks and enhance the agency of survivors.

Across this hothouse discussion three big challenges emerged that also contained opportunities. The first was how technology can keep up with perpetrators, who tend to adapt their approaches in response to new technological innovations on the part of NGOs and law enforcement. Speakers and attendees offered the solutions of providing data directly to end users who can then help refresh and nuance the data to form a feedback loop. Ideas included staying ahead of constantly changing data patterns by designing a series of tools that allow regular updates from the outset (for example, adding or removing questions and languages); committing to the need for constant maintenance of AI tools, including in the underlying funding for projects; and engaging in a constant process of forecasting where we predict tools that traffickers may pick up in the future.

The second was how to use technology in ways that reach everyone, or at least more communities and populations than are included in the obvious social media platforms. Speakers and discussants observed that although more and more people have mobile phones, they remain in a fragmented global digital community, where not everyone is part of the same networks. Tech-based anti-slavery solutions therefore face the challenge of accessing diverse populations, and NGOs may make presumptions based on that limited reach. The discussion concluded that we need to access people in ways that reflect their networks and realities, and to achieve this we must work harder to understand the motivations and contexts of front-line responders, constantly surveying the possibilities and limitations of their approaches to technology use.

[6] "Modern-Day Slavery", *The New York Times,* 9 September 2000.

The third major challenge that emerged from the ICT hothouse was the presence of "unknown unknowns". These trouble the tech and anti-slavery communities alike, because both communities are aware of the sheer number of known unknowns—for example how to reach women or linguistic minorities effectively with anti-slavery programmes or new technologies. Because we confront so many known unknowns, we know there is likely a daunting number of unknown unknowns. Speakers and participants pointed in response to the promising approach of collecting and indexing open data to piece together intelligence. By mining large collections of public data and indexing indicators, where anti-slavery actors would otherwise not see patterns and structure, we might at least identify more of our unknown unknowns.

Ultimately, this hothouse, like the wider Code 8.7 event itself, asked the question: can a science of anti-slavery help to achieve a better anti-slavery movement? One that can design a pathway to a slavery-free world by 2030 because it has catalysed accurate mapping and measurement and brought a deep understanding of slavery's nature and drivers? One that knows what slavery is, where it takes place, how many people it affects, how it takes root and persists and what works to end it?

But this hothouse, like all the Code 8.7 hothouses and discussions, also recognized that at the heart of a scientific anti-slavery movement there must be a human-machine fusion: the development of new scientific, data and technological approaches for measuring, mapping and analysing slavery, but around the voices, ideas and human agency of some of the world's most vulnerable people. Particularly during the discussion of survivor-informed apps and how vulnerable communities can use technology to support their empowerment, agency and dignity, the ICT hothouse discussion recognized that a science of anti-slavery should revolve around "rigorous morality".[7]

This term, formulated by Code 8.7 participant and Rights Lab Executive Director Professor Todd Landman, describes "a turn away from any notion that social scientific research has to be (or can be) value free" and an attempt, instead, to draw on "a deep tradition of empirical work that seeks to make social (and political) science matter." Rigorous morality means championing problem-based research that remains systematic while producing outputs that are of public value. For Code 8.7 participants as they take forward the lessons of the conference into a longer-term collaboration, this means seeking a research approach that is as much about humanity as it is about technology: delivering anti-slavery "effective measures" that are designed around cutting-edge methods and the agency of survivors.

[7] Todd Landman, "Rigorous Morality: Norms, Values, and the Comparative Politics of Human Rights", *Human Rights Quarterly,* vol. 38, No. 1 (February 2006).

MINING GOVERNMENT DATA TO REACH TARGET 8.7

Davina Durgana
Senior Statistician, Walk Free Foundation

Code 8.7 convened world leaders on anti-slavery efforts, technology and academia to determine the best methods of harnessing the potential of artificial intelligence, computational science, satellite imaging, machine learning and more to optimize efforts against modern slavery. A critical component of this effort includes optimizing insights available from government data for law enforcement intervention, predictive vulnerability assessments and crime mapping to improve resource allocation.

The Mining Government Data session included speakers Luis Fabiano de Assis from SmartLab Brazil, Clare Gollop of the UK National Policing Modern Slavery Portfolio and Julia Kocis of the Lehigh County Regional Intelligence Center. These speakers presented their efforts to optimize government data to measure prevalence and model vulnerability to modern slavery from multiple sources including law enforcement, prosecution, social welfare, unemployment and regional socioeconomic vulnerability factors.

This session focused on four major areas of discussion:

- Structured and unstructured, temporal and spatial data and their coordination;
- Implementation of network analysis and graph theory;
- Communication to policymakers; and
- Analysis coordination.

In terms of the types of data that are required for these efforts, we addressed the challenges of integrating structured and unstructured data. Unstructured data includes free-form and narrative information from law enforcement and police reports that provides key contextual information for investigations, but which are resource and time-intensive to mine by hand. Similarly, dimensions of temporal and spatial data must be addressed in data integration into existing or new models. Coordinating and sharing data across multiple disparate law enforcement entities, across as many as 40 local law enforcement agencies, state and federal groups require rigorous organization and concerted effort.

Some presenters spoke directly to their use of network analysis and graph theory to optimize the analysis of data that they have obtained, and to facilitate communication to policymakers. Each of the presenters and our audience responded to concerns about communicating these often complex findings accurately and succinctly to policy and other stakeholders. Some of our panelists recommended wrapping graphs and data around stories and broader narratives to contextualize findings for policymakers. Finally, coordination of multi-tiered analytical teams and their findings was a critical next step to ensure that data analyses were operationalized. Not having a coordinated strategy for analytical teams and data findings integration could defeat the effort made to conduct these analyses from the outset.

In the truly collaborative nature of these sessions, the audience and panelists together developed eight major takeaways from the session: collect data for a purpose; apply boundaries to network analysis; answer a few questions well; even a basic or rudimentary model is better than nothing; create space for feedback loops; do not limit efforts to a coalition of the willing; avoid implicit bias in AI models; and integrate survivor perspectives.

Purposeful data collection based on what you need rather than just what may already be available is critical for meaningful analysis. Clare Gollop shared this advice from her time developing multi-tiered analytical teams. The data that were already being collected by national policing reports were

not sufficient to answer the questions they had and so specifically defining their own questions had a substantial impact on their ability to meaningfully analyse this issue.

Network analysis needs boundaries. It is important to establish boundaries around what information will and will not be considered in analysis. This is particularly important in the context of network analyses of law enforcement data when there are substantial opportunities for infinite relevant connections in a modern slavery case. Julia Kocis found that there was so much detail in law enforcement case records, that without establishing boundaries when conducting network analysis, researchers could find infinite relevant connections to an operation and boundaries need to be established.

Our session emphasized that we need to invest in answering a small number of specific questions really well. All presenters acknowledged the challenges they faced in prioritizing these research questions in the context of high-pressure and immediate-delivery work environments. Luis Fabiano de Assis ensured that his work in Brazil focused on key socioeconomic indicators to identify at-risk municipalities for modern slavery, and Clare Gollop clearly defined the questions she was analysing prior to commencing her research project.

Often, we found that even a basic or rudimentary model is preferable to allowing law enforcement interventions and resource allocations to be directed by anecdotal evidence, political alliances, priorities or rhetoric. Even using broad risk and vulnerability factors to assess optimal regions and municipalities for intervention, risk prediction and resource allocation is an ideal first step. Luis Fabiano de Assis discussed that his models are appropriate and necessary first steps to ensure that resource allocation decisions and law enforcement interventions are based on some relatively objective sociological data as opposed to intuition or unfounded assumptions.

Our audience emphasized the importance of incorporating feedback loops into predictive models to ensure that they become as useful and accurate as possible. As each of these models are operationalized and tested, the audience encouraged the panelists to formalize feedback mechanisms whereby the tools themselves could be improved by findings on the ground.

Some of our panelists also discussed the challenge of extending efforts beyond “coalitions of the willing”. This describes a situation where we may have stakeholders gathered that wish to be involved in these efforts, but these stakeholders may not necessarily be the only ones you require for effective intervention. It is important to cultivate all willing participants, but also to put significant effort into bringing critical actors to the table, even if they are resistant.

In modelling machine learning algorithms or beginning to implement AI in models, it is important to not build in implicit bias such as hand-selecting trial or test cases. All models are only as good as the data and assumptions underlying their development. We must be aware of our own biases in order to fully avoid perpetuating cycles of misinformation and harmful or inaccurate bias as this could defeat the utility of using more advanced tools.

Finally, it is important to involve survivor perspectives in the analyses of case data is critical to fully understanding the context of these situations. Survivors provide important insight into testable hypotheses and can contextualize findings and component data that comprise these models.

SLAVERY FROM SPACE

Hannah Darnton
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As technology becomes cheaper and increasingly more accessible—from cell phones, to drones, to miniature satellites—it is changing the nature of who can use it and how it can be applied to address new and existing social issues.

The Slavery from Space hothouse focused specifically on the novel uses of technology such as satellite imagery, drone footage and earth observation and mapping to identify human trafficking, while simultaneously considering how the application and use of such technology effects the social and political dynamics of the world in which we live.

As Austin Choi-Fitzpatrick aptly stated during the discussion, increased access to tech has led to a democratization of the services technology provides, including surveillance. By democratizing surveillance, technology has allowed the wider population, including the disenfranchized and non-elite, to play a role in how surveillance can be used, and to push the boundaries of application to address pervasive social issues.

This session highlighted these positive applications—also detailed in this Science article[8] —which included connecting the dots between indicators of human trafficking and the physical sites of exploitation. It also articulated key issues to keep front of mind as we continue to expand the remit of technology as a solution.

There is an inherent tension between technology and politics. Technology, particularly the new and disruptive technologies discussed over the course of Code 8.7, provides new perspectives and insights into the world around us. Drones, for example, can see and record things we were unable to see before, uncover information, and thereby have the potential to serve as accountability mechanisms, holding groups responsible for their actions, or, at times, their inaction. Simultaneously, the presence of these new technologies changes our behaviour. A crowd, for example, acts differently when it knows it is being observed or recorded, shifting its actions as a reaction to a drone collecting footage overhead; while political actors, such as embassies, have taken on new measures to protect themselves from the threat of surveillance overhead, instituting new forms of protection and privacy to account for the changing landscape of technology.

Tech alone can't solve our problems. It cannot replace political will or civil society action; a human component or on the ground understanding of the issues is still needed to maximize impact. As Doreen Boyd from Rights Lab stated, AI is being used in earth observation already, but humans are needed to decide where to focus the lens.

Collecting data is the easy part. However, data is only as valuable as the ability of the groups on the ground to use it. The actionability of data and the decision to act requires infrastructure and resources beyond the technology itself.

Technology has to be selectively applied. Power and politics matter, and we need to remain cautious of putting it in the right hands. Just because there is data on an issue does not mean that it will or should be utilized; we need to put technology in the hands of leaders willing to use these tools to lead widespread social change.

New insights may not confirm our beliefs. We need to keep in mind that these new insights—gleaned from satellites, drones or other forms of new technology—may not support what we currently believe. As Andrew Zolli from Planet Labs mentioned, in the human rights sector, and particularly in the fight again human trafficking, we are working with information deficits, and much of the time we are working off of hunches. The application and use of new technologies will allow us to increase our levels of information and provide evidence on the issues we are facing, both confirmed and disconfirming.

This hothouse made it clear that slavery is a 21st century problem, and 21st century tools are needed to fight it. Satellite technology is already being used in novel ways to address modern slavery and human trafficking, but the is still a great deal of unlocked potential. Code 8.7 made it clear that stakeholders are excited to find ways to unlock this potential and expand who can make use of this technology.

[8] Sarah Scoles, "Researchers spy signs of slavery from space", *Science* (19 February 2019).

FINTECH

Kilian Moote
Project Director, KnowTheChain

Too frequently people are treated like commodities in our technology-powered world. In most instances, the exploitation of an individual generates a financial transaction, and/or contributes to the financial gain of an individual or company. This hothouse looked at different ways these financial flows could be identified and disrupted, making the act of exploiting someone too costly, and eliminating the financial gain from trafficking.

Maria Mahl, from Arabesque, a specialist environmental, social and governance (ESG) quant asset manager; Liz Barrick from the Transaction Record Analysis Center (TRAC), a centralized searchable database of the financial transactions of global money services business; and Bill Peace from STOP THE TRAFFIK, a campaign coalition that aims to bring an end to human trafficking worldwide discussed three different types of data that could be used to shift this paradigm:

- Structured data (commonly in the form of suspicious financial transactions);
- Unstructured data (information provided by civil society groups or service providers working with victims); and
- Publicity available information (social media data or news).

Structured Data

Structured data is collected in a consistent way, regardless of the institution collecting the information. Financial institutions have heavily regulated processes to collect information in common and shareable formats. Banks are able to use this information to help construct typologies of risk in order to improve their systems for identifying suspicious activities, ensuring higher rates of compliance with Know Your Customer regulations. The collected data is also made available to law enforcement for use in investigating and identifying instances of trafficking. For example, the telephone numbers provided for wire transfers can be cross-referenced with the phone numbers listed on websites advertising commercial sex.

However, while there is some nascent interest in using structured financial transactions to better identify where workers are paying exploitative recruitment fees, the ability to do this type of analysis is still unproven. One tool that has shown great potential is Southwest Border TRAC, which has used more than 80 million points of data from financial transactions to identify instances where traffickers are using financial institutions to transfer money. Although this type of information is incredibly valuable and provides interesting opportunities for sophisticated data analysis, the scope is limited to trafficking transactions that touch formal financial institutions. The tool also often depends on a commercial advertisement or some other piece of information that validates the financial transaction likely related to trafficking. Therefore, the tools that are currently best used to identify sex trafficking or other forms of exploitation have a direct commercial connection.

Unstructured Data

Building on the aggregation of structured data, organizations like STOP THE TRAFFIK are working with technology providers such as IBM to layer in data from frontline organizations.[9] This provides an additional layer of intelligence for understanding trafficking patterns. Such information can be used to create a more sophisticated form of trafficking typology, providing greater context around the types of populations in a given region that may be at-risk to trafficking. Better integration of unstructured data from civil society groups or service providers strengthens tools used to identify or predict where trafficking routes may be occurring.

[9] IBM, "Stop the Traffik: Using intelligence analysis technology to disrupt and prevent human trafficking" (October 2017).

Unlike structured data, collecting and integrating unstructured data can be quite labour intensive and can be difficult to compare. Creating common collection processes for this unstructured data is critical, and collaborations like the one between STOP THE TRAFFIK and Liberty Shared to help frontline service providers input case data in a consistent and comparable way are a positive step.

To expand this type of data collection, barriers related to data security and labour intensity will need to be overcome. Service providers working with survivors and at-risk populations may be hesitant to collaborate on these types of tools, as risks to their beneficiaries may exist. Trust among these partners is paramount to greater adoption of data collection and sharing tools.

Publicly Available Information

The billions of pieces of publicly available data generated every day by individuals using social media as well as the daily onslaught of news produced globally is another resource in the fight against modern slavery. Effectively harnessing this information requires utilizing machine learning and sentiment analysis to identify the helpful nodes in a sea of billions of disparate data points.

The sustainability quant firm Arabesque presented on the ways in which they use this type of information to screen investments to better understand if trafficking may have an impact on their investments. To fully harness this type of information requires a technical sophistication and capacity to utilize machine learning. It is also difficult to connect social media information to financial risk for companies. Similarly, in an age of "fake news", analysis of news sources may be based on inaccurate information. Similarly, "headline risk" is more acute for consumer-facing or well-known brands, not those actors that are more likely to be using forced labour to a significant degree.

Beyond utilizing data and technology to intervene, participants also discussed other ways that the financial and investment system is connected to human trafficking, including how to better control access to financial markets for different actors. For example, might there be other ways to use financial technology to increase financial inclusion for survivors and at-risk populations?

Financial security is commonly seen as one of many vulnerability factors for at-risk communities. In a similar way, might there be other ways to limit the ability of actors taking advantage of people from accessing the financial system?

While the financial sector has been using structured financial transactions to combat trafficking, there has been limited consideration of how to use technology in other ways. The breadth and depth of the discussion during the Fintech hothouse clearly illustrates that there is a greater need and opportunity to explore this topic more closely in the future.

FINDING HIDDEN POPULATIONS – ORPHANAGE TRAFFICKING

Paul Jones
Visiting Researcher, The Alan Turing Institute

Chloe Setter
Senior Advisor, Lumos Foundation

Code 8.7—an event designed by UN University Centre for Policy Research to bring together anti-slavery experts, computational science, AI and data specialists—presented an opportunity to explore new approaches to fighting modern slavery by hosting several "hothouses" in which experts were given a problem to brainstorm.

Our hothouse looked at on orphanage trafficking, a little-known form of child exploitation that involves children being recruited from families into residential institutions for the purpose of exploitation. Orphanages should be consigned to the history books. Yet in 2019, not only do they still exist, but they are actually on the rise in some parts of the world. This is despite more than 80 years of research proving the harm they cause to children and the increased cost compared with family-based care.

We began with presentations from the Lumos Foundation, describing what is currently known about orphanages globally. An estimated 8 million children are living in institutions around the world, but due to a lack of quality data, it's suspected that the real number is far higher.

Many in the room were surprised to learn that around 80 per cent of children in institutions are not actually orphans, and that, in some instances, orphanage tourism—or voluntourism—seems to be a major driver of their recruitment. But how could we better understand this phenomenon that sees children being recruited from their families and placed into orphanages in order to drive donations, volunteers and visitors? How might we estimate the true scale of the orphanage business?

Through its work in Haiti, Lumos has been able to demonstrate huge quantities of funding going into orphanages in the country, where it is thought that 32,000 children reside in institutional care. Only 15 per cent of these orphanages are officially registered and evidence was uncovered of children being recruited from their families under the promise of a better life, while orphanage owners kept children in appalling conditions, profiting from their childcare "business". This is child trafficking, but it is not currently captured in any identification systems globally or prosecuted by law enforcement.

We enlisted the help of the tech and slavery experts at the hothouse to brainstorm in two groups. The first covered "defining, operationalizing and measuring orphanage trafficking" and the second looked at "technical solutions for finding hotspots, financial flows and data sources".

In order to steer data collection, it is first necessary to define a clear set of indicators, or features, that are likely to be indicative of this type of trafficking. These could be manually validated with a variety of known cases, before attempting to construct any kind of data science model that may try to assign a level of "risk" to individual institutions or a risk model for vulnerable populations.

Such efforts must also be reconciled with the longer-term goal of working towards rehoming all institutionalized children in family-based care, rather than attempting to "rate" individual institutions, which can create an unhelpful perception of good versus bad orphanages.

A key theme that emerged from both groups was that of seeking new data collection opportunities to address the large knowledge gap that exists on this issue. Currently, data collection is spotty, relying heavily on small-scale interview and survey-based studies. New methods need to be considered, ideas included self-reporting (by staff, volunteers or even children in institutions), perhaps via secure websites or mobile applications, or amending existing surveys, such as the Global Slavery Index,[10] to seek more evidence on this form of exploitation.

The use of satellite imagery—as was demonstrated in earlier sessions by the University of Nottingham's Rights Lab in identifying brick kilns—was also discussed as a means of mapping unregistered institutions where trafficking may proliferate.

The participants also agreed that it would probably be most fruitful to focus on the data trail from orphanage tourists and voluntourists themselves, which is perhaps more easily obtainable, for instance through social media commentaries, online advertising and perhaps even through some kind of declaration of orphanage volunteering at immigration. Information could also be gleaned from the agencies and tour guides offering volunteering opportunities, perhaps summaries of where they are sending volunteers and also feedback from local guides working with the agencies.

Throughout the sessions, a variety of non-technical strategies to bring about change were also discussed. These included a focus on awareness campaigns for potential "voluntourists" (e.g. at schools, universities, travel companies) and attempting to change perceptions that persist implying children are better off in institutions or that there are no alternatives.

Participants left the session brimming with ideas and positive about how technology might help eradicate this outdated model of care and accompanying commodification of children. Many noted that this form of trafficking is unique in that it is largely enabled by well-intentioned funding and resources. This means that, as soon as people become aware of the issue, we are all a big step forward towards solving it.

[10] Walk Free Foundation, *The Global Slavery Index 2018* (2018).

TOWARDS A PIPELINE – TECHNOLOGY, TECHNIQUES AND TRAINING

Nadya Bliss
Director, Global Security Initiative at Arizona State University

Advances in computational science and artificial intelligence offer opportunities to advance Target 8.7 of the Sustainable Development Goals, but the anti-trafficking community must first establish some core building blocks that can serve as the foundation upon which new technologies can be developed and shared. Simply throwing flashy new tech at the problem is neither strategic nor effective. Key components of this foundation include a shared strategy, a common infrastructure that allows for better and more sharing of data and a pipeline that shepherds ideas from basic research to applied research to operationalization and finally to demo and validation.

The session "Towards a Pipeline – Technology, Techniques and Training" tackled this challenge by looking at four opportunity areas that can be categorized into different components of the research pipeline:

- Is artificial intelligence a silver bullet? (basic research)
- Common data collection and taxonomy protocols (applied research)
- Data trusts (applied research)
- Getting the tech community involved (demo and validation)

Developing a pipeline is well-defined in other domains. A good example to draw from is the United States Department of Defense guidelines on science and technology research,[11] which define different components of the pipeline from basic research through implementation.

Artificial intelligence (AI) fits into the basic research or applied research component of this pipeline. Anjali Mazumder of the Turing Institute explained that it is not a silver bullet, but it does present opportunities if leveraged properly. Specifically, AI can help:

- Measure prevalence and map vulnerability;
- Prevent trafficking by helping to understand drivers and pathways to exploitation, and identify possible interventions;
- Pursue perpetrators and identify victims, and build decision support systems to better predict potential occurrences;
- Prosecute perpetrators by building tools that are reliable and admissible in court; and
- Support victims and the anti-trafficking community through more efficient resource allocation.

For AI to be effective though, tools must be developed with a recognition of the potential for algorithmic bias, with relevant legal frameworks in mind and by multidisciplinary teams that include non-technologists.

[11] Donna Fossum, Lawrence S. Painter, Valerie L. Williams, Allison Yezril, Elaine M. Newton, *Discovery and Innovation: Federal Research and Development Activities in the Fifty States, District of Columbia, and Puerto Rico* (Santa Monica, California, RAND Corporation, 2000).

Data sharing is a key component of the operationalization of any tool in the area. This requires a shared infrastructure that promotes more and deeper collaboration, both among sectors (industry, academia, industry) and actors in the anti-trafficking community (NGOs, governments, research organizations).

The first step in this type of infrastructure is developing data standards: documented agreements on representation, format, definition, structuring, tagging, transmission, manipulation, use and management of data. Harry Cook of the International Organization for Migration discussed current efforts to create such data standards. One primary benefit of data standards is that it creates readable data that can be automatically shared and distributed among disparate actors. Developing a common language that allows different actors to use the same terminology with the same meanings will also help with transparency.

Challenges to creating data standards are significant, with the privacy of survivors paramount. Thus data standards must include rules for governance such as avoiding personally identifiable information (PII) whenever possible, establishing strong protections for PII if collected and ensuring survivors are able to provide input into how data is collected and used. Finally, data should not be collected blindly, simply to collect data. All data collection efforts should have a clear purpose.

Data trusts could be critical to effective data sharing, as explained by Steve Anning of the British Army. Data trusts are proven and trusted frameworks and agreements that ensure exchanges of data are secure and mutually beneficial.

The anti-trafficking community is multi-sector, multidisciplinary and international, and consequently has different ideas of how to handle data. Data trusts would allow collaboration as a community in a trusted manner, enhancing opportunities for successful analysis and effective policy-making.

There are three key components of a data trust:

- Shared ethics: members of the trust must use agreed-upon methodologies;
- Architectural: a portal for use of data by members;
- Governance: pre-agreed upon procedures for handling data.

Getting the tech community involved can foster the growth of capacity in front-line organizations and the groups working on the ground to support survivors and combat trafficking. Large tech companies have significant expertise building technology that works and deploying it widely and effectively, skills that can be beneficial to anti-trafficking efforts. Phil Bennett started Tech Against Trafficking to do just that, but noted two requirements for these efforts to be successful:

- Technologists must get involved in the space to avoid becoming distant from the human story and the potential consequences of their technology.
- Second, he cited the need to start building the pillars of infrastructure that are necessary for information sharing and increased collaboration.

This session focused on areas that align with the beginning and end stages of a research pipeline. The next steps need to focus on the middle stages, or operationalization, and how to translate these ideas and efforts into an executable plan. This will require identifying metrics that can be used to measure progress toward the goal.

CREATING INCENTIVES FOR ACTION – RESEARCH, REGULATION AND REWARDS

James Cockayne
Project Director, Delta 8.7

Dr Zoe Trodd began this session by reminding participants that savvy use of statistics, data visualization and mapping technology has been at the heart of abolition efforts for over 200 years. As the rich variety of creative uses of AI, machine learning and technology discussed in previous sessions had shown, the challenge is not to conceive how these techniques and technologies may assist anti-slavery efforts; it is rather to think about how to incentivize that kind of approach, and ensure that the resulting effort adds up to more than the sum of its parts.

Professor Keith Marzullo began the discussion with an overview of how government, academic and private sector partners can interact to foster effective innovation and research collaboration. The traditional model, involving government providing funding inputs, sometimes in collaboration with private sector stakeholders, and the research community providing ideas, has been disrupted in recent years. Now, we see greater overlap between information, policy and technology sectors, with funding existing as a cross-cutting issue for all of them.

In response, research actors have developed several new strategies that help them achieve impact as innovation hubs:

Go large: framing research inquiries through institutionalized "centres" of excellence, whether real or virtual;

Go broad: defining a broad research agenda, where possible linked to larger policy puzzles, to foster broad impact. This often results in interdisciplinarity in research design and execution; and

Go experiential: making these initiatives highly participatory—not just the redoubt of technical experts in far-off ivory towers, but drawing in early career researchers, students, business and members of the broader community. This helps generate social buy-in and social capital around the initiative, as well as fostering discursive continuity and social sustainability.

Next, Dr Daniel Lopresti discussed the role of the Computing Community Consortium as a catalyst for computational research, through networked activity. Dr Lopresti described a number of activities that CCC undertakes that could be applied to help to catalyse research related to Target 8.7. CCC's task forces offer small, agile, limited life-time initiatives for accelerating mobilization in particular areas. Its workshops can help develop new research agendas, ensuring buy-in from the North American computational science research community. CCC can also serve a match-making function, connecting computational research expertise to operational actors that need it. And it can foster foundational research to underpin the development of more advanced research and programming.

Third, Sophia Tu discussed efforts by IBM to develop secure data-sharing arrangements. In a first collaboration with Liberty Shared, STOP THE TRAFFIK, financial institutions and law enforcement, as part of its "purpose alongside profits" approach, IBM developed an app that allows "anyone, anywhere in the world" to report suspected cases of human trafficking, and has been used, said Ms Tu, to disrupt trafficking enterprises around the world. Now, IBM is developed an IBM-cloud-based "hub" for sharing and blending information from civil society, financial sector institutions and open source data, generally from news sources.

In response to the speakers' presentations, I suggested that the speakers' remarks pointed to the need to recognize that—like cancer or climate change—modern slavery is both a knot of complex research questions and an evolving public policy challenge. Unlike climate change and cancer, however, the Target 8.7 field lacks a clear understanding of the hierarchy of research questions that need to be answered to foster forward progress on this policy puzzle, and also lack access to the kind of national research strategies that we see in the fights against cancer and climate change.

Further elaborating this point, one participant in the discussion that followed suggested a need to consider how Code 8.7 could develop from a community of interest into a community of intent. Beyond the broad goal of fostering progress towards Target 8.7, what is the shared intent of this community? What are its research goals, and what is the use case for the applications of AI and machine learning it seeks to foster?

Participants also noted that the absence of some basic shared infrastructure—such as a secure, trusted data-sharing system—has impeded progress. This is, in part an incentives or public goods problem: as one participant noted, "Everyone wants to buy a car, but no one wants to pay for the road." Other participants noted that solutions to this problem may be emerging, for example in the IBM data-sharing infrastructure mentioned above, in Delta 8.7, in the information-sharing infrastructure emerging in Europe through EU and OSCE collaboration. Others pointed out that governments have a history of investing in public research infrastructure—CERN, for example—when presented with a strong case with clear potential public payoffs from the research, and clear buy-in from diverse stakeholders. Others noted that public-private partnership models might be conceivable through subscription-based analytic outputs, for instance. Finally, other participants saw a strong case for tech companies to get more heavily involved.

Some participants highlighted, however, that several recent attempts to mobilize the anti-slavery community around data-sharing have foundered on questions of incentives and trust. Even as Code 8.7 works to develop an overarching vision and framework for collaboration, it may be necessary to build trust up from the bottom, through practical instances of collaborative problem-solving. Here, Code 8.7 may have an important catalytic and match-making role.

A SURVIVOR PERSPECTIVE

Sharlena Powell
Community Organizer, Voices of Women

I wanted to provide a Survivor Leader's perspective of the Code 8.7 conference, especially since the sessions focused on a rather unusual subject in the eyes of a survivor: artificial intelligence and computational science.

The Code 8.7 Organizing Committee brought together a phenomenal wealth of knowledge and expertise to strategize how to use technology to end modern slavery worldwide. I was grateful to be among the four Survivor Leaders who were given the opportunity to attend the event, thanks to the Code 8.7 Survivor Leader Scholarship Programme.[12] I appreciated how straightforward the scholarship application was, and I'm happy the Organizing Committee made it so that there were no barriers for survivors to overcome in order to be seated at the table.

The conference felt very inclusive. Beyond the presence of survivors, there was effort made to include diverse stakeholders and speakers from academia, international organizations, business and civil society as well as the general public through the use of social media and by live streaming the event.

The first day kicked off with a survivor perspective, something that is usually saved for the concluding comments, often appearing as an afterthought. Speakers from AnnieCannons discussed their "Earn to Learn" programme as well as their take on using machine learning to upgrade the quality of care given to survivors. Their mission seeks a survivor-centred design, with roots in finding, elevating and echoing survivor voices. Also mentioned was the importance of accurate data. With the economic opportunities available through their organization, AnnieCannons pinpointed methodologies for hiring trafficking survivors, addressing the underlying risks survivors face in becoming homeless and starving post-rescue, and helping survivors find a path towards independence.

The agenda made space for many opportunities to connect with others throughout the conference. I was happy to brainstorm with Jennifer Gentile Long, the CEO of Aequitas, an NGO currently developing data optimization techniques in the fields of human trafficking and domestic violence. Aequitas also assists several United States government agencies, city governments and non-profit organizations to identify trends and key indicators for effective strategies between touchpoints where survivors may interact with government systems and support services.

In the "Mining Government Data to Reach Target 8.7" hothouse, Luis Fabiano de Assis of SmartLab explained his focus on combining vulnerability measurements, digital observatories and storytelling to predict risks and identify where future rescues can be possible. This type of open and notable communication is where true progress can gain momentum. Researchers can honour survivors' stories as they work to tackle the multilevel issues of modern slavery and human trafficking.

There was also an interesting discussion on integrating targeted surveys into the US Census to estimate probabilities of human trafficking, which seemed to be a very timely suggestion. Including survivors' perspective in this exercise could make approaching populations that are unaware of what human trafficking is more productive. Furthermore, unless findings are updated and maintained, data can become easily outdated. This is where computational science comes in as an accelerator, allowing information to be unpacked quickly and efficiently. There is also a need to develop a universal glossary of terms created by survivors with input from researchers, which would facilitate this work.

I was also struck by the conversations on moving away from being reactive and instead being predictive and developing real-time solutions. One important thought to bear in mind, sparked by a conversation with Heidi Cooper of Polaris, was that there are great challenges in proving

[12] "Code 8.7: Survivor Leader Scholarship", *Delta 8.7*, Available at https://delta87.org/code-8-7-survivor-leader-scholarship/

the impact of an intervention when it is focused on preventative measures. That was one "aha" moment for me at this conference.

Phil Bennet also gave an empathetic and erudite intervention, saying "We don't want to drop a rock in the river and think the water will stop flowing. Instead, we need to build a dam. Intelligent technology is that dam." He also mentioned the importance of tracking the life cycle of cases, including the treatment phase and final outcomes.

Certain comments struck a negative chord, particularly the mention of "survivors rarely using the future tense, or talking in any way about the future" and "atemporality." These comments were very generalist and disempowering to the vast survivor community. Although there was a follow-up on "living in a total present [state]", many survivors often take such statements to be discouraging character judgements.

As a community organizer, advocate for combatting violence with several New York-based NGOs and member of several anti-trafficking task forces, I often ask myself the question raised by Sophia Tu of IBM's corporate citizenship department: "What is the motivation for a company to be a part of this work?" As Code 8.7 made clear, one answer is that sustainability and protecting human rights can be good for a business's bottom-line.

I appreciate the opportunity to document my truths. I'm here to offer a practical assurance to survivors and our collective future: "Stay Woke" in articulating your views on these complex issues. When it's necessary, interrupt what you thought was normal, and design your own kind of big data sourcing that works for you. Whether it be focused on healing mechanisms or economic stability, just know that you are and can be in control of your tomorrow and live what you create every day.

HOW WE CAN ADVANCE COLLABORATIVE PROBLEM SOLVING

Code 8.7 Organizing Committee[12]

Computational science, artificial intelligence and machine learning have huge potential for accelerating the fight to end modern slavery and achieve Target 8.7 of the Sustainable Development Goals. Realizing that potential will require a cultivated mix of bottom-up innovation, lateral learning and strategic coordination – including with funders and donors. Without careful, strategic and coordinated action, the danger is that we will fail to exploit the real and significant opportunities to which we were all awoken at the Code 8.7 event in New York in February 2019.

From a community of interest to a community of intent

The Code 8.7 event made clear that there is now a convergence of interests between the anti-slavery community and the computational science community. That convergence reflects the overlap between the anti-slavery community's interest in access to computational methods, tools and techniques and the computational science community's interest in using and generating new data sets and research problems derived from real-world applications. But it is also a product of shared social motivations and an underlying commonality of intent to use these tools to solve social problems.

The challenge now is to transform this emerging community of interest into a community of *intent*. This requires building a framework for collaboration that creates incentives for innovation while achieving collective impact.

The good news is that we are not starting from scratch. Code 8.7 demonstrated that there is already a great diversity of basic research and operational experimentation bringing AI, machine learning and computational science into the anti-slavery field, using a variety of data sets, covering everything from remote sensing image analysis and financial transactions analysis to survivor rehabilitation case management and vulnerability mapping. There is, however, a gap between basic research and operational experimentation, on the one hand, and, on the other, the development of applied technologies at scale, delivering strengthened global understanding of modern slavery and what works to address it. The "middle of the technology pipeline is missing", as one participant put it.

The Heilmeier Catechism, used by DARPA to figure out which research and development investment risks are worth taking, provides a powerful framework for approaching technology pipeline development.[13] And on the more operational side, tech companies have a track record of building and scaling technological solutions. Harnessing their know-how may help accelerate progress towards this objective. As some participants noted, thought may also need to be given to coordination of funding streams to ensure the full length of the research and development pipeline is funded, covering not only government funding

[12] The Code 8.7 Organizing Committee includes Delta 8.7 (James Cockayne), Global Security Initiative at Arizona State University (Nadya Bliss), Rights Lab at the University of Nottingham (Doreen Boyd, Zoe Trodd and James Goulding), Tech Against Trafficking at Business for the Social Responsibility (Hannah Darnton), Computing Community Consortium (Ann Drobnis and Daniel Lopresti), and The Alan Turing Institute (Anjali Mazumder).

[13] DARPA, "The Heilmeier Catechism", Available at https://www.darpa.mil/work-with-us/heilmeier-catechism.

for basic research, but also private funding for the translation and application of basic research findings.

Still, as several participants cautioned, there were limits and downsides to the potential of AI, machine learning and computational science. We must not adopt an uncritical technological utopianism.

For starters, there is a persistent and fundamentally constraining lack of standardization in this field, even on basic technical issues such as how to describe and code forced labour, modern slavery, human trafficking and child labour. Progress in this field will require that some of the recent gains in statistical research, such as the development of a taxonomy of exploitation embedded in the most recent ILO *Global Estimates of Modern Slavery*,[14] and in the recent ICLS guidelines on measuring forced labour,[15] are translated into technical data and coding standards.

Second, there remain clear and persistent barriers to information and data-sharing. These include technological and infrastructure gaps; regulatory and legal barriers, some arising from efforts intended to ensure data protection and the right to privacy; and, even more fundamentally, a lack of trust on the part of survivors and frontline civil society actors that data will not be monetized or mishandled. Participants stressed the urgent need for solutions to these problems in the short term. At the same time, some computational science participants stressed that while such solutions might be found in the short-term, even better solutions might be available in the medium to long-term, if actors in this field were prepared to invest time and resources in research on these questions.

Third, an ongoing lack of strategic coordination among donors, funders and resource-allocators means there is likely to be significant inefficiency, duplication and funding gaps in current efforts to bring technology, AI and machine learning into this field. We say "likely" because in reality we do not know, with any accuracy, how funds are spent in this field. Almost four years after the adoption of the SDGs and several years after Alliance 8.7 was created to provide a global coordination platform, we lack a clear picture of global spending and activity to achieve Target 8.7.

The Organizing Committee for the Code 8.7 event walked away with the perception that Code 8.7 could be developed into a framework for collaboration that met some of these needs and addressed some of these obstacles. Here, in closing, we set out in broad brushstrokes what that framework might involve, seen from two different angles.

Code 8.7 as a strategic framework for applied research

The community of interest that coalesced around the Code 8.7 event could, with some encouragement, develop into a community of intent. Keeping survivors front and centre in that discussion will be important; and it may be necessary to bring in additional stakeholders, such as more representatives of the private tech sector. But the central challenge is to define and record our shared intent and turn it into a strategic framework.

Beyond "accelerating progress towards Target 8.7", what is the intent we share? Answering this question, through a structured process intended to scope the participating stakeholders, the flow of inputs—funds, tech capabilities, research capabilities—and expected outputs will allow this community to develop a shared purpose. Within the Organizing Committee, CCC and Turing may be particularly well placed to convene sessions or processes intended to crystallize this shared intent. And there may be scope for such a process to connect in to other ongoing processes, such as the policy research agenda formulation exercise

[14] International Labour Organization and Walk Free Foundation, *Global Estimates of Modern Slavery* (Geneva, 2017).

[15] International Labour Office, Department of Statistics, "Guidelines concerning the measurement of forced labour", ICLS/20/2018/Guidelines.

that ILO will lead within a US Department of Labor-funded project exploring future research inputs to Delta 8.7.

Centrally, this process should also allow the Code 8.7 community to clarify not only the kinds of research questions it is seeking to address, but also the conceptual and operational hierarchy among them. Which questions or operational issues need to be addressed first, to enable forward progress on the others? Answering this question will help Code 8.7 translate a shared strategic objective into a shared strategic framework, with sequencing and prioritization of interim milestones towards the ultimate goal.

Listening to discussions at Code 8.7 in New York, the Organizing Committee tentatively identified the following three dimensions of a strategic framework. It intends to explore these three dimensions and consider at an upcoming meeting how they might be translated into a public, timebound strategic research framework.

Dimension 1 – Data standards and collection frameworks

In an initial phase, Code 8.7 activities would focus on rapidly building out shared data standards and collection frameworks to allow participating members to rapidly scale-up data-related activities. This may need to cover both technical norms (such as coding typologies) and data-sharing infrastructure, potentially through the establishment of a "data trust". There may be lessons to be learned here from related fields, notably public health, and there will be a need for engagement with survivors, and legal and ethics experts. Where possible, efforts along this dimension would build on and scale up existing, trusted initiatives, such as CTDC's work on data standards, or other emerging data-sharing initiatives.

Dimension 2 – Technology pipelines

Simultaneously, or potentially in sequence, Code 8.7 would provide a framework underpinning activities by members developing new technology pipelines. This could include framing and inception workshops; collaborative research design and implementation; and research evaluation. We heard four possibilities coalesce during the two days of Code 8.7:

- Global Slavery Observatory – existing initiatives, such as the Slavery from Space project, others involved in imagery analysis, Delta 8.7, the Brazilian Slavery Observatory and CTDC, could work together to develop a Global Slavery Observatory, offering close-to-real time mapping of incidence and dynamics;
- Case tracking and management – there were strong signs that AI, machine learning and computational science could radically transform case tracking and management in the anti-slavery field. There appears to be particular scope for AI-assisted case management software to nudge decision-makers towards practices and outcomes that are more effective (whether seen in terms of outcomes for victims and survivors, likelihood of conviction of perpetrators, asset recovery or some other systemic factor).
- Risk modelling and mapping – Target 8.7 risk modelling is undergoing something of a revolution, drawing on new statistical techniques, and fuelled by the private sector's growing need for supply-chain risk data, not least as a result of supply-chain due diligence legislation in California, the UK, Australia, France and beyond. A technology pipeline focused on this area could help ensure experimentation in this area converges in ways that deliver systemic value, such as interoperability with prevalence measurement analysis or case management.
- Financial data analysis – another boom area, we see a rapid rise in the use of computational science in banking, remittance and investment transaction data to understand risk and returns, manage down risk and identify value investment opportunities. Again, a technology pipeline focused in this area could have systemic benefits.

Dimension 3 – Research mapping and monitoring

Finally, a central element of a shared research framework would need to be both a mapping of research opportunities and a system for monitoring progress over time. This could, for example, begin with a research-focused white paper, identifying different research questions and problems and different strategies for addressing them over time. Numerous problem-sets emerged already from this two-day conference, including around data fusion to deal with limited ground-truths; network analysis; natural language processing, especially of unstructured data, to identify causal pathways related to modern slavery. This Dimension might also consider the development of research and research impact metrics, and a system for periodic review of research developments.

Code 8.7 as a human learning community

Whether or not the Code 8.7 community is able to translate its shared interest and intent into a formal, public strategic framework for applied research, we saw strong interest at the New York event in Code 8.7 continuing to support mutual learning. Code 8.7 might have been about artificial intelligence and machine learning, but we left the event with a strong sense that it is natural intelligence and human learning that is central to this enterprise.

There are numerous ways that Code 8.7 could serve as a vehicle for the development, publication and reporting on research, operational and analytical work on these issues, whether or not that is reduced to a formal strategic framework.

First, with a small secretariat, Code 8.7 could organize membership events. These would:

- encourage information sharing and lateral learning;
- allow the deliberate development of a structured and progressively-developing discourse on these issues. Code 8.7 could, for example, publish analytic reports, proposals or joint research reports on specific issues, to be debated at membership events;
- provide a venue for teaching;
- help maintain and strengthen the social capital in this network.

Second, Code 8.7 could play a match-making role, connecting demand for computational science, AI and machine learning expertise within the Target 8.7 community to suppliers of relevant expertise. A centralized match-making or clearing-house function would reduce the costs of search for those in the market, foster interest from researchers and students, and, importantly, allow the secretariat to develop a sort of "market trends" analysis, which will allow regular insight for the community about how collaborative research and problem-solving are developing.

Third, Code 8.7 could support joint research and fund-raising by its members.

Fourth, Code 8.7 could foster the development of good practice insights and standards development. Initially, this might be linked to the development of technical data standards, as explored in Dimension 1 above. In time, this might develop into a broader norm-development or norm-dissemination role, for example allowing the promotion of standards developed elsewhere, such as the Worker Engagement Supported by Technology (WEST) Principles[16] (focusing on technology-driven efforts to address human rights abuses in supply chains) or the Ethical OS Toolkit[17] (intended to help technologists think critically about the different ways their proposed technology influences human behaviour and interactions). A soft norm-development role for Code 8.7 would contribute to strengthened interoperability, comparability and automation in Target 8.7 data initiatives; help strengthen transparency and accountability in those efforts; and foster the protection of survivor rights.

[16] "The Principles", WEST Principles, Available at https://westprinciples.org/start-with-integrity-and-purpose/

[17] "Ethical OS Toolkit", Available at https://ethicalos.org/

Conclusion

As survivor leader Sharlena Powell reminded us all as the Code 8.7 event in New York closed, whether and how computational science, AI and machine learning make a real difference to efforts to achieve Target 8.7 of the Sustainable Development Goals depends on us, not the technology. Code 8.7 may have helped to awaken some in the anti-slavery community to the potential gains, and some of the risks involved. And it may have awoken some in the tech community and the computational science research community to the urgency of the issues addressed by Target 8.7. But if we do not "stay woke", as Sharlena Powell exhorted us all, not only to the opportunities but to the risks, this positive potential will pass us by.

The Organizing Committee intends to work with interested parties in the months ahead to figure out a framework for moving forward. As Sharlena's exhortation should also remind us, survivors need to be central to this exercise. We will need active participation from researchers, the tech community, anti-slavery actors and governments. And funding will be a real question, as it always is. The challenges are real. But the potential from closer collaboration between the anti-slavery and computational science communities is far too significant to allow that to deter us.