

Towards a Research Program in Humanitarian Service Science & Engineering

Mark P. Haselkorn, Ph.D.

Professor and Founding Chair, Department of Technical Communication
Director, Pacific Rim Visualization and Analytics Center
Director, Interdisciplinary Program on Humanitarian Relief
markh@u.washington.edu

ABSTRACT

This paper provides a brief history of recent activity fostered by the U.S. National Science Foundation (NSF) that has led to ongoing discussion, investigation, analysis and community building around an area being called “Humanitarian Service Science and Engineering” (HSS&E). HSS&E is an extension of market-based “service science” into humanitarian and government service areas where there is a less clear and more complex “customer/provider” relationship; where criteria for optimization extend beyond single, relatively straightforward criteria such as efficiency or cost to include numerous, often competing goals involving complex areas such as politics, social justice and values; and where fundamental infrastructure such as power, transportation and communication cannot be assumed. HSS&E explores the applicability of existing modeling methodologies to this expanded, more complex environment of service science and engineering, and in doing so has identified the need for an integration of qualitative and quantitative methodologies beyond that which currently exists.

On June 8-10, 2006, the three-day NSF workshop on *Humanitarian Service Systems: Developing an Interdisciplinary Research Agenda* took place at Lake Naivasha, Kenya.¹ The significant conclusions of this workshop were derived from two sources: (1) the open and far-reaching discussion of representatives from government (Kenyan Office of the President, Kenyan Office of e-Government, Rwanda ICT Authority), academia (Georgia Institute of Technology, University of Washington, Moi University, University of Southern California, University of Mississippi, Kinchasa School of Public Health, and Harvard), NGOs (World Vision International, VillageReach), donor agencies (USAID/FFP, USAID/OFDA, UN OCHA), and industry (Centurion Systems Ltd.), and (2) the experience of being in East Africa.

Prior to and during the workshop, a major famine in the northeastern districts of Kenya was receiving international attention. As part of a massive international response, USAID’s food program (represented at the workshop) spent approximately \$200 million that year feeding people in these districts. Yet there seemed to be sufficient food in the parts of Kenya visited by workshop participants. Local attendees confirmed that while the drought was a natural (and repeating) disaster, the famine was a man-made disaster because roads had not been built to support delivery of available food to the stricken area from other parts of the region. All, including USAID attendees, agreed that investing in local transportation capacity so the region could care for itself made more sense than the repeated spending on direct food aid.

The conclusions of the workshop discussion further confirmed this perspective. NGO representatives envisioned a future when they would no longer be in the direct aid business, but rather would focus on capacity building, measurement, evaluation and standards. Agreed upon guiding principles were that action and decision-making should occur at the lowest possible level and that all service programs and systems must be, first and foremost,

¹ See *Envisioning the Future of International Humanitarian Service Activity and a Research Agenda to Help Get Us There*, NSF Final Report (in progress).

socially, culturally and organizationally appropriate. To support these principles, a research agenda was proposed with the goal of better understanding, designing, deploying and sustaining the value of:

- a shared, open GIS-based information infrastructure
- user-centered information systems for coordination and service management
- shared, continually optimized logistics systems
- internationally accepted standards and monitoring methods

Following the Kenya workshop, it was decided to cap off this OISE project with a small planning meeting to determine next steps. With a supplement from SEE, this planning meeting was held at NSF on January 26, 2007. The meeting brought together researchers, including modelers from the operations research field, with practitioners from NGOs and the military, as well as donors from UNOCHA and USAID's Office of Disaster Assistance (OFDA). A primary area of discussion focused on whether and how predictive models like those used in operations research could be applied to the situations and systems of humanitarian service workers. The interchange was fascinating and informative.

Operations researchers began by asking the practitioners questions that would enable them to apply their models to humanitarian service activities. Questions like "How do you do X?" were generally answered with some version of "It depends." Questions about goals and measurements of success were even more confounding. Practitioners told many stories of complex goals and incentives that seemingly went beyond usual market-based models based on profit and efficiency. For example, when the U.S. Navy hospital ship *Mercy* anchored off Banda Ache following the Indian Ocean tsunami, it offered facilities like beds, refrigerators and showers to those responding to the post-disaster needs of the devastated area. One NGO operating in Banda Ache had a stock of vaccine that desperately needed refrigeration or it would spoil. Given a goal of reducing human suffering, the basic operations issue seemed to be the logistics of getting the vaccine on board the *Mercy*, into refrigeration units, and then out to people in need of vaccination. But this was not the issue discussed in a hastily called all-night meeting of the NGO.

The central issue for this NGO was whether the value of the vaccine to reduce suffering in Ache was more important than the possible loss of the appearance of neutrality that visible cooperation with the U.S. military might bring. While the loss of the vaccine would greatly reduce the NGO's capacity to reduce suffering, the loss of the appearance of neutrality could greatly reduce the NGO's capacity to reduce suffering in many other regions of the world where it was currently operating and was likely to operate in the future. The NGO's decision was to let the needed vaccine spoil, rather than risk their valued neutrality. To account for situations like this, the predictive models of engineers and business researchers needed to account for complex incentives stemming from political, social, behavioral and environmental realities.

As the meeting went on, it became clear that there was a larger realm of "service science and engineering" research of which previous research, focused on market-based service, was a critical, but generally less complex, subset.² Participants identified three important ways in which humanitarian and government service situations tend to be more complex than market-based service situations:

1. Market-based service research assumes a provider/customer relationship, but in humanitarian and government service the person receiving the service is generally not the one paying for it. This greatly complicates the analysis of key elements such as service "value."
2. Market-based service research assumes goals of efficiency and profit, with the market providing a concrete mechanism for assessing the success of a service enterprise. There is no such mechanism for determining the success of humanitarian and government service enterprises. Assessment measures are far less clear and far more dependent on the numerous and often conflicting goals of service partners.

² With estimates of up to 80% of the U.S. economy being based on service delivery, it is important to separate the issue of complexity from the issue of significance. Of course economic impact is not the only measure of significance. The impact of the 20 – 30 billion dollar international humanitarian sector on the lives of people in our world, while much smaller in dollars than market-based service, is certainly significant in ways that go beyond the dollar value of the activities.

3. Market-based service research assumes a fairly stable infrastructure, such as the availability of power or a functioning transportation system, but humanitarian service is greatly complicated by the failure or inadequacy of infrastructure as well as the impact of disasters and emergencies on existing systems for meeting human needs.

Meeting participants discussed the applicability of existing modeling methodologies to this expanded notion of service science and engineering. They identified the need for an integration of qualitative and quantitative methodologies beyond that which currently existed. “Humanitarian Service Science and Engineering” (HSS&E) was discussed as a potential emerging field for research innovation and a larger workshop on this topic was identified as the best next step.

In May 2007, the UW submitted a new proposal to SEE for a “Humanitarian Service Science and Engineering Workshop.” It was proposed to address a number of key questions about HSS&E, including:

1. What are the central research questions of HSS&E?
2. Would answering these questions be ground-breaking and transformational?
3. Is there a community of researchers prepared to answer these questions?
4. Are these questions already being sufficiently addressed through existing programs?
5. Is HSS&E research sustainable?

The award was received in July with the workshop taking place on October 8th, 2007. It was a unique and highly interdisciplinary gathering, with participants including leaders from a wide range of relevant disciplines (computer science, civil and environmental engineering, emergency and risk management, GIS, global affairs, human development and family sciences, industrial engineering, information science and systems, medicine, operations management, planning, public affairs, public health, sustainability, systems engineering, technical communication, and urban planning); organizations (government, industry, military, NGOs, United Nations, and universities); and locations (Germany, Kenya, Netherlands, South Africa, Sri Lanka, Sudan, and, predominantly, the United States). (See Appendix 3 for a list of participants.) Discussion was energetic and highly motivated with participants clearly recognizing the opportunity presented by this unusual gathering and the charge, under the auspices of NSF, to assess a potentially significant emerging research frontier.

The report from the October 8th workshop will be out in the first half of 2008, hopefully in time for the ISCRAM meeting in May. It will present the outcomes and conclusions of this workshop and hopefully be another important step in the development of an emerging research program in Humanitarian Service Science and Engineering.

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