DATA-DRIVEN DONOR FUNDING FOR NONPROFITS

THE IMPACT OF TECHNOLOGY ON NONPROFIT ORGANIZATIONS

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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With charitable organizations contributing $1.05 trillion to the US economy and composing 5.6% of the country's GDP in 2016, the nonprofit sector plays a significant role in the lives of those in need as well as in the economic functionality of the United States (NCCS Project Team, 2020, para. 2). The National Center for Charitable Statistics (NCCS) Project Team (2020) states in their 2019 Nonprofit Brief that private charitable giving rose consecutively from 2014 to 2017 to reach the highest point in history, only to drop 1.7% in 2018 (para. 2). This lack of donors is an issue that lends itself to a push to integrate technology into current nonprofit systems in order to increase donor recruitment. In the technical report, this problem will be addressed using a data-driven approach to find out about how The Children's Inn at the National Institute of Health (NIH) can raise additional funds from donors.

Tightly coupled with this, the STS research will explore answers to the question of how data can be used to make an impact within nonprofit organizations. The report aims to find out more about how data can be leveraged to improve upon current nonprofit systems and ultimately contribute to fundraising efforts. Improvements found in this section can be recommended to The Children's Inn at NIH to further advance their program. This could also provide valuable expenses that the funds raised from the technical project can be directed towards.

Advised by William Scherer of the Engineering Systems and Environment department at the University of Virginia, this technical project will be conducted by a group of four students studying Systems Engineering from the same university, consisting of myself, Joshua Eiland, Clare Hammonds, and Sofia Ponos. The client that is involved with the work of the technical report is The Children's Inn, a nonprofit organization that serves as a residential home for families with children participating in leading-edge research at the National Institutes of Health (NIH). The NIH is able to take care of the child's needs and partner with the families to advance

medical discoveries, while The Inn provides comfort (“About The Inn”, n.d., para. 1). The project started in September of 2020 and is planned to be completed before May of 2021.

DATA DRIVEN DONOR FUNDING FOR NONPROFITS

The technical project aims to discover new fundraising strategies for The Children’s Inn at NIH, more specifically with regards to collecting individual gifts from donors. Charitable donations have gone in new directions this year, as donors and foundations respond to the pandemic and then to social justice causes, potentially leaving less for organizations like The Children’s Inn (Sullivan, 2020, para. 1). In fiscal year 2019, The Inn’s number of clients served, number of volunteers, emergency fund support provided and number of programs offered were already down from fiscal year 2017 and 2018 (“Children’s Inn at NIH, Inc.”, n.d.). By working to find new donors, we hope to increase The Inn’s donations so that they can care for more families, especially in this time of uncertainty.

The objectives of the report are to (1) expand and diversify The Inn’s base of supporters by uncovering new supporters and re-discovering the old supporters and (2) produce a predictive analytics dashboard and other models/analysis that will provide The Inn staff with a flexible and thoughtful strategy for donor identification and management. Our approach is to mine The Inn’s database and additional information sources that we deem worthy of exploration in order to answer relevant questions regarding important donation indicators, donor demographics, and potential key attributes that are missing from the database. The additional sources include Census data and data from consulting groups who have worked with The Inn. The project will require systems thinking in order to conduct a thorough systems analysis, as well as manipulation of data in order to produce meaningful analytics. The tools to be used include, but are not limited to:

Tableau, Minitab, R Studio, Python, and Microsoft Excel. There will also be consulting with Jerry Montgomery from 5W Strategists in order to receive additional demographic data about the donors that can be used to identify trends and customer segments. The research team hopes to learn more about the nonprofit space and donor tendencies as well as improve upon the skills involved in their approach.

As listed previously, one of the anticipated outcomes from this technical project is to develop a model that will help The Inn to identify donors that could increase their funding. This outcome can be accomplished by calculating a model for the customer lifetime value (CLV), or expected funds to be raised from a single donor within their lifetime, for different donor segments based on the factors of recency, frequency, and monetary (RFM) (Sohrabi & Khanlari, 2007, p. 17). From this, we can attempt to target those donors with predicted high CLV values. Figure 1 shows the process that will be taken when using the RFM models. Data from the listed data sources will be run through an RFM model in which the fields of recency, frequency, and monetary are used to segment the donors. After conducting further research into retention and recruitment strategies, a specific strategy can be suggested to The Inn depending on which

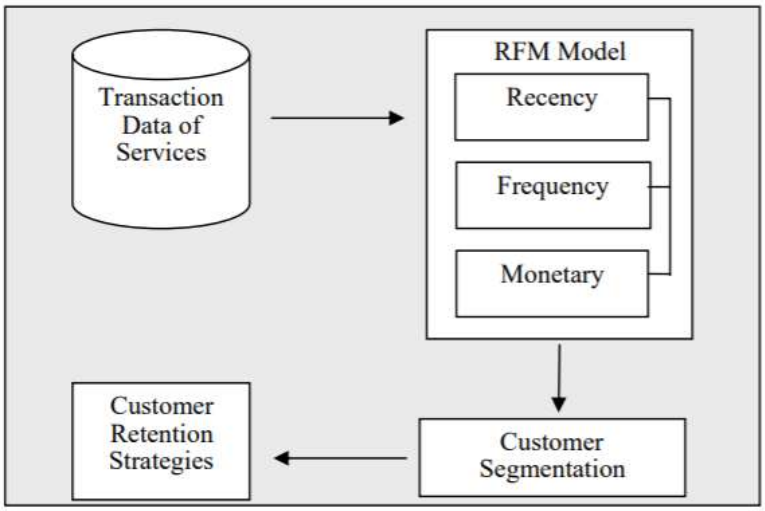

Figure 1: Conceptual framework of research: Using transaction data from services in an RFM model to create customer segments and create new strategies (Sohrabi & Khanlari, 2007, p. 14)

segment the donor falls within. The goal is to leave The Inn with a dashboard that allows them to monitor the metrics that are determined to be most indicative of donations and allow them to make strategic decisions from these insights. The metrics could include information about customer segments and the lifetime value of their donors. It would be beneficial to The Inn if they could target their appeals towards a specific customer segment and then view the expected lifetime value of the customers based on the true segments they were able to recruit.

The model that will be created can be improved by following a number of techniques. Multicollinearilty, which occurs when the independent variables are highly correlated, would have to be addressed in order to prevent false conclusions that a variable is not significant. The technique to combat this is performed by logically removing some variables with high correlations to one another. Categorical variables, such as gender or location, will have to be transformed using either dummy variables, in which a 0 or 1 is assigned for the category depending on which category the donor lies in, or an Empirical Bayesian method, in which a number between 0 and 1 is assigned for the category so that it matches the proportion of the data that belongs to this category. To account for potential nonlinear relationships of continuous variables, higher order models may need to be created. Model validation techniques allow the model to be tested against hold out data to check if the predictions are correct. These techniques include using an out-of-sample data set to avoid problems with overfitting, and plotting hits and false alarms on a receiver operating characteristic (ROC) curve to ensure that the model is predicting correctly more than not (Key, 2001, pp. 336-341)

The work being done with The Inn will result in a traditional independent technical report that is being written as a research paper. By researching about and looking at nonprofit data, I hope to develop solutions that can benefit the organizations that are making a real social impact.

Society has moved into the Information Age, and learning how to leverage data and IT are the building blocks to success in the modern world.

THE IMPACT OF TECHNOLOGY ON NONPROFIT ORGANIZATIONS

The nonprofit sector has been facing a multitude of challenges in recent years. According to Hackler and Saxton (2007), charitable organizations have been increasingly put in direct competition with both for-profit entities and a growing number of other nonprofits (p. 474). With almost double the number of organizations in the 25 years leading to 2007 and a paid employment jump from 5 to 7 percent of the U.S. total, nonprofits have been hit hard by decreased government funding as well as an increased demand for their services (Hackler., & Saxton, 2007, p. 474). These circumstances serve as the reason as to why nonprofits have both an imminent need for technology and limited accessibility to these advances. Geller et al. (2010) outlined the reputation of nonprofit organizations to be "widely assumed to be technologically challenged, largely bereft of the cutting-edge hardware and software needed to function effectively in the new information era" (p. 1). While these claims seem to be somewhat of a fallacy with nonprofits being able to integrate current information technologies into a wide range of their organizational activities, many of these organizations still remain behind the curve in terms of maximizing IT's full potential (Geller et al., 2010, pp. 2-6).

As shown below in Figure 2, this problem requires more attention as about a third of nonprofits are limited in their technology usage for program and service delivery (Geller et al., 2010, p. 3). Figure 3 shows that the majority of nonprofit organizations lack the money, time, expertise, staff and evaluations necessary to increase the usage of IT for program and service delivery (Geller et al., 2010, p. 7).

The objective of this research work will be to learn more about the usage of modern IT, specifically data, by nonprofit organizations and ways that it can be leveraged to improve upon their current systems. For example, databases now exist that can connect donors and foundations to organizations that would best utilize their funds for communities in need. These can be specified towards specific relevant causes like social justice movements or COVID-19 charities. Vanguard uses geography to show donors three major criteria to assess the coronavirus's impact, and Give Blck aims to call attention to Black-founded nonprofit organizations that were little known or too small to be highlighted by some of the leading philanthropic rating services (Sullivan, 2020, para. 7-24). Analysis of big data can also be used to develop a donor-centric, multichannel, and modern nonprofit. The data can be converted into information, insights, and value and used to create strategy, goals, and actions that will drive the direction of the organization (MacLaughlin, 2016, p. 14). Learning how to use these different data strategies will allow struggling nonprofits to both increase revenue and have the money to further improve their technological efforts through hiring staff, collecting data, and purchasing reports.

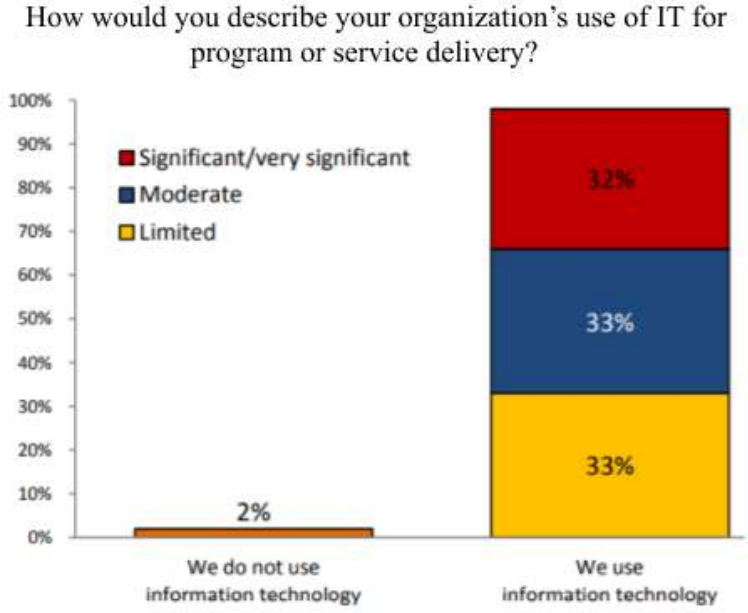

Figure 2: Nonprofits in The Johns Hopkins Nonprofit Listening Post Project Information Technology Sounding answer how they would describe their organization's use of IT for program or service delivery (Geller et al., 2010, p. 3)

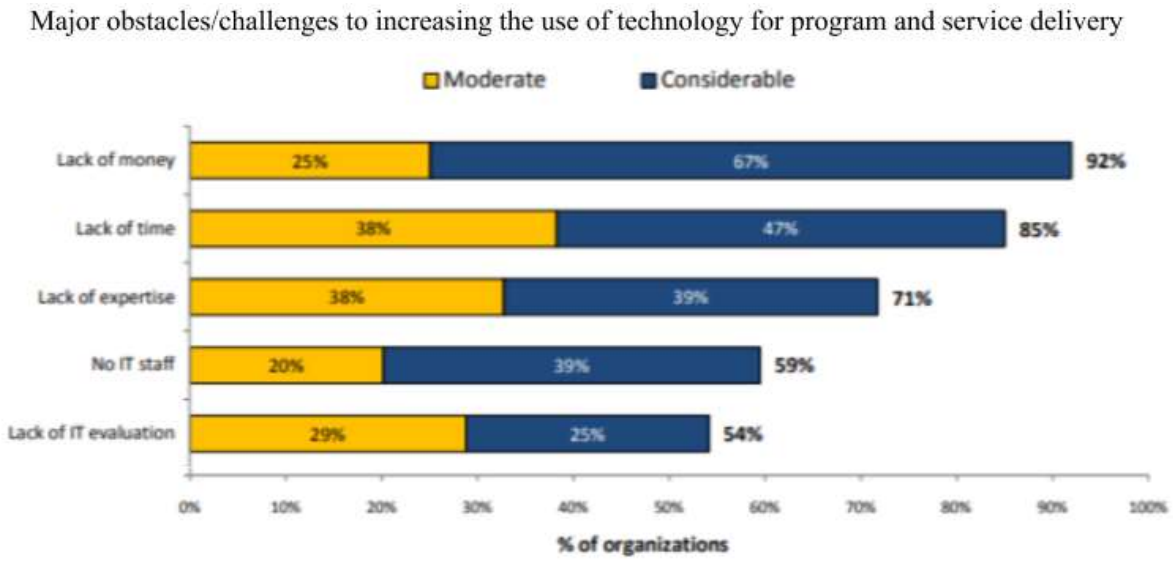

Figure 3: Nonprofits in The Johns Hopkins Nonprofit Listening Post Project Information Technology Sounding what the major obstacles/challenges are to increasing the use of technology for program and service delivery (Geller et al., 2010, p. 7)

ACTOR NETWORK THEORY APPLIED TO THE NONPROFIT SECTOR

This research paper will focus on an approach organized around Actor Network Theory (ANT). The "network" component of ANT represents the "systems of behavior and social practices that are intertwined with material objects", while the "actor" component emphasizes the "presence of many actors, human and nonhuman" (Johnson, 2005, p. 1792). This actor-network relationship exists within nonprofits as well. Figure 4 shows the network between the primary organizational and human actors in terms of revenue. Some material actors can be added to create further relationships. The role of technology as an actor will contribute largely to how organizations will spend their funds. Currently, it is perceived that a lack of revenue from sources of funding and funding intermediaries to nonprofit service providers prevents the nonprofits from purchasing technology. If performed correctly, an increase in technology funds

could also increase the revenues from both sources to the nonprofit, who will hopefully be able to provide more funds to the recipients of service.

This STS research project will be a written as a research paper with the anticipated outcome being to identify a variety of uses of technology that will benefit the nonprofit organization actors within their network, as well as to understand why there could exist a deficit

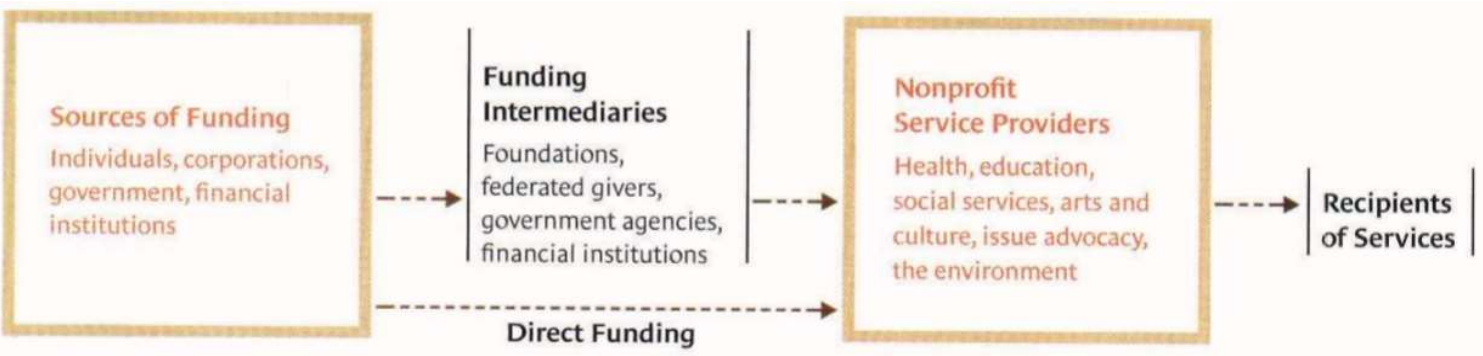

Figure 4: Human and organizational actors involved in the nonprofit sector: Funds are transferred from multiple sources to the nonprofits and ultimately to the service recipients (Bradley et al., 2003, p. 97)

in technology in this sector in the first place. Tying this project back to the technical report, improvements found in this section can be recommended to The Children's Inn at NIH to further advance their fundraising and service programs. This could also provide valuable expenses that the funds raised from the technical project can be directed towards.

WORKS CITED

Birkholz, J. (2008). *Fundraising Analytics: Using Data to Guide Strategy*. John Wiley & Sons, Inc. https://books.google.com/books?hl=en&lr=&id=BZ36DwAAQBAJ&oi=fnd&pg=PP7&dq=nonprofit+fundraising+data&ots=ut9nJzUKPf&sig=Lt61jjxtFyrhLF-FjAwJHK1UZQI#v=onepage&q&f=false

Bradley, B., Jansen, P., & Silverman, L. (2003). The nonprofit sector's $100 billion opportunity. *Harvard Business Review*, *81*(5), 94–103. https://web-a-ebscohost-com.proxy01.its.virginia.edu/ehost/pdfviewer/pdfviewer?vid=1&sid=98473e28-e718-43b0-840a-c394bc7f0410%40sessionmgr4006

Corder, K. (2001). Acquiring new technology comparing nonprofit and public sector agencies. *Administration & Society*, *33*(2), 194-219. https://doi.org/10.1177/00953990122019730

Geller S., Abramson A., & de Leon E. (2010). The nonprofit technology gap - myth or reality? The John Hopkins Center for Civil Society Studies. https://www.researchgate.net/profile/Erwin_De_Leon/publication/275336167_The_Nonprofit_Technology_Gap_-_Myth_or_Reality/links/5538169f0cf226723ab615a2/The-Nonprofit-Technology-Gap-Myth-or-Reality.pdf

Guidestar. (n.d.). Children's inn at NIH, Inc. https://www.guidestar.org/profile/52-1638207#summary

Hackler, D., & Saxton G. (2007). The strategic use of information technology by nonprofit organizations: Increasing capacity and untapped potential. *Public Administration Review*, *67*(3), 474-487. https://doi.org/10.1111/j.1540-6210.2007.00730.x

Johnson, D. (2005). Social construction of technology. *Encyclopedia of Science, Technology, and Ethics*, *1*(4), 1791-1794.

Key, J. (2001). Enhancing fundraising success with custom data modelling. *International Journal of Nonprofit and Voluntary Sector Marketing*, *6*(4), 334-346. https://doi.org/10.1002/nvsm.159

Lampkin, L., & Boris, E. (2002). Nonprofit organization data: What we have and what we need. *The American Behavioral Scientist*, *45*(11), 1675-1715. https://doi.org/10.1177/0002764202045011005

MacLaughlin, S. (2016). *Data Driven Nonprofits*. Saltire Press. https://static1.squarespace.com/static/56242dd4e4b0099ac9cc7413/t/57c6ded9440243071d37aef6/1472650970099/DataDrivenNonprofits_BlackbaudExcerpt.pdf

Merkel, C., Farooq, U., Xiao, L., Ganoe, C., Rosson, M. B., & Carroll, J. M. (2007, March). Managing technology use and learning in nonprofit community organizations: methodological challenges and opportunities. In *CHIMIT '07: Proceedings of the 2007 symposium on Computer human interaction for the management of information technology*. Association for Computing Machinery. https://doi.org/10.1145/1234772.1234783

NCCS Project Team. (2020). *The nonprofit sector in brief 2019*. National Center for Charitable Statistics. https://nccs.urban.org/publication/nonprofit-sector-brief-2019#the-nonprofit-sector-in-brief-2019

Sohrabi, B. & Khanlari, A. (2007). Customer lifetime value (CLV) measurement based on RFM model. *Iranian Accounting & Auditing Review*, *14*(47), 7-20. https://www.sid.ir/EN/VEWSSID/J_pdf/81420074701.pdf

Sullivan, P. (2020). As donations shift in the pandemic, new databases aim to help. *The New York Times*. https://www.nytimes.com/2020/09/25/your-money/donations-social-causes-coronavirus.html

The Children's Inn at NIH. (n.d.). *About the inn*. https://childrensinn.org/learn-more/

https://foundationsource.com/wp-content/uploads/resources/2020-Client-Survey-Year-That-Changed-Everything-09-21-20.pdf