

**Development of Powershare, a Mobile Application for Improving Civic Accountability,
Transparency, and Engagement**
(Technical Topic)

**Prioritizing Sustainability in Civic Hackathon Software Development to Promote
Successful Integration of Civic Technologies into the Public Sector**
(STS Topic)

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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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Introduction

Civic technologies, or civic tech, information and communications technologies (ICT) used to connect citizens, local communities, and public administrative bodies, have mostly failed to integrate into the public sector; according to Skarzauskiene & Maciuliene (2020), most civic technology initiatives have failed "to yield innovative solutions, the consensus among stakeholders, or even collective action of any kind" (p. 3), and Hou and Lampe (2017, p. 28) indicate that civic technologies continue to have a low perceived value and sustained use in public organizations. Civic technology has great potential for benefitting citizens' daily lives and improving citizens' confidence in public administration, by improving the quality and clarity of public services, increasing citizen involvement in public decision making, and promoting information sharing (Boehner & DiSalvo, 2016). In order to attract socially motivated people with diverse backgrounds to collaboratively develop civic technologies, both governments and private actors have organized civic hackathons, time-limited software development competitions to prototype technical solutions for societal challenges (Ermoshina, 2018; Gordon & Lopez 2019). Because civic technologies have a multitude of potential benefits, stakeholders that participate in discussions about a particular civic technology or technical artifact in civic hackathons often have varying definitions of problem and goals being addressed and differing expectations of the technology's role to address those problems. This complexity leads software engineers to fixate on the technical aspect of very specific problems presented by a small number of stakeholders at these hackathons.

In order to take advantage of civic technology's potential, instead of being relegated to just providing "another outlet for the already engaged and vociferous" (May & Ross, 2018, p. 214), as well as wasting resources in developing unused civic tech, Yoshida & Thammetar

recommend that the problem definition and development process for creating civic tech should involve more product stakeholders in the problem definition process and place sustainability and accessibility as priorities when reconciling the different expectations of civic tech (2021, p. 56). The technical portion of this thesis documents the development of a civic technology with requirements provided by an external non-technical stakeholder, and the STS portion addresses the disconnect between research on how to create more sustainable civic software projects and its prevalence in practice in the context of civic hackathons.

Technical Topic: Development of Powershare, a Mobile Application for Improving Civic Accountability, Transparency, and Engagement

Civic technologies, such as government social media, have demonstrated their capability to increase government transparency, which is significantly related to public trust in government (Song & Lee, 2016). However, few civic technology projects produced during civic hackathons have been adopted by the public sector. Project teams in hackathons use software development techniques commonly employed by the software industry to create minimum viable products, versions of products with only enough features to be usable, in order to demonstrate groups' capabilities and gain credibility among external stakeholders (Knutas et al., 2019, p. 46). Failing to address the lack of transparency in government can facilitate general distrust of public administrative bodies, contributing to software engineers' existing aversion to interaction with public officials and institutionalized politics (Ermoshina, 2018, p. 92). Inadequate stakeholder engagement and requirements specifications during software development can lead to software that fails to account for and mitigate its various negative implications.

The technical portion of this prospectus covers the development of Powershare, a civic technology project aimed at improving citizen participation, transparency, and accountability in

government officials' decision making, during two semesters of a computer science practicum course. The project was presented to the technical advisor by a customer that wanted a product that would address the lack of accountability to and interaction with constituents that local elected representatives had when making decisions in order to increase public trust in government bodies. The customer believed that many other citizens had similar desires in the local community, driven by his personal experiences and work in examining social networks, and wanted more frequent communication and discussion of goals between elected officials and citizens and among citizens through an online channel.

The technical project is an attempt to build a civic technology that can be successfully adopted, while also allowing the participants to demonstrate and practice the agile methodology and techniques involved with executing the stages of the software development lifecycle. The technical advisor and course requirements established the deliverables and required artifacts before the project team started meeting with the customer, and, similar to civic hackathon projects, the technical project's final deliverable was a minimum viable product to be presented to the customer. The project team interacted with customers to discern and negotiate technical, actionable requirements from their non-technical requirements, which also serve as a metric for the progress of the project and serve to. This process of negotiating priorities with stakeholders mirrors how hackathons encourage developers to prioritize features necessary to complete a minimum viable product over other requirements, such as software sustainability or adoption success factors. If successful, the project can serve as an example of how practicum courses can produce practical and productive settings for emulating software engineering practice in a manner similar to civic technology hackathons, where the goal is the creation of a minimum viable product within a limited amount of time. The main challenges on the path to completion

are to balance the prioritization of the requirements imposed by the course, such as fixed deliverable deadlines, along with the requirements imposed by the product owner, such as including a user authentication system. The technical project was completed and presented to the customer in May, 2019.

STS Topic: Investigating Cultural and Organizational Challenges in Prioritizing Adoption and Sustainability in Civic Hackathon Software Development to Promote Successful Integration of Civic Technologies into the Public Sector

In the context of civic technologies, sustainability refers to "the feasibility for public organizations to adopt, maintain, update, and develop civic technologies" (Hou & Lampe, 2017, p. 26). Civic hackathons have been unable to consistently produce sustainable software, despite being one core component in the civic software development ecosystem. Hackathons are events that have been organized in order to bring together people with the necessary skills and motivation to find creative solutions to specific problems. Civic hackathons leverage the time-limited competition format to find creative solutions to civic problems by facilitating collaboration between people with diverse background knowledge, skills, and resources, and they provide a significant source for seeding civic hacking projects. Projects developed by teams during the allotted time are judged and rewarded by sponsors and interested organizations. According to Knutas et al., (2019) other software development organizational patterns, such as open source software projects have demonstrated that "that volunteer-based communities can set up processes with characteristics of software engineering processes, including the systematic use of theories, methods, and tools to achieve desired levels of quality, acceptability, and maintainability" (p. 41). However, few civic technologies resulting from these hackathons have successfully been adopted into society (Hou & Lampe, 2017, p. 27). The civic projects face

similar challenges in requirements specification, stakeholder engagement, and reorienting from development to product delivery (Knutas et al., 2019, p. 41). Hackathons also have common resources for running and organizing them online, allowing practices to be shared between hackathon groups (Ermoshina, 2018, pp. 86-87). However, recommendations from academic research for creating sustainable software and addressing these challenges have yet to be incorporated into hackathons.

The theoretical academic analysis of civic technology and its relationship with society risks becoming too far removed from practical use for civic stakeholders (Boehner & DiSalvo, 2016, p. 2979; Moore, 2020, p. 419). If the research intended to improve a system is not applied to the civic hackathons, then the enthusiasm for hackathons could decline despite the novel innovative space that hackathons provide. Civic hackathons appeal to coders by portraying them as doing "useful" coding for "social" meaning instead of just coding for technical beauty or efficiency (Ermoshina, 2018, p. 92). Hacking project teams already face the challenges of low newcomer engagement and lack of mentoring, and low project success rates could contribute to the decline of incoming interest (Knutas et al., 2019, p. 49). In addition to losing the enthusiasm of civic hackers and other participants, the hackathons waste their potential to foster innovation, using volunteer software development time and manpower with low project success rates.

The STS work seeks to provide insight into how to incorporate existing recommendations for the adoption and sustainability of civic technologies into civic hackathon projects by analyzing the cultural and organizational structure of the civic hackathon ecosystem, specifically focusing on communication and information sharing between civic hacking organizations, between civic organizers and civic hackers, and between civic developers and civic tech research. Similar to previous research related to civic technology development and human

computer interaction, this work is expected to investigate hackathon organizers, such as Major League Hacking, and compare case studies of hackathons and other software development organizational patterns, such as open source software projects.

Conclusion

In order for society to fully utilize the benefits of civic technologies and mitigate its negative implications, research on the adoption and sustainability of civic technologies must be applied to software development practice. The technical work consists of a production-ready application that allows for communication between constituents and their elected representatives and fosters discussion around shared goals, which is expected to serve as an example of how civic hacking might perform in a university course development environment, revealing its challenges and similarities to hackathons. The STS research will attempt to explore ways to apply the results of research on sustainable civic technology development to civic technology development practice used in civic hackathons. The STS research will hopefully provide a list of emergent themes and recommendations similar to previous literature that can be applied in practice to distribute and implement prior research findings and recommendations among a network of civic tech hackers and hackathon organizers.

References

- Boehner, K., & DiSalvo, C. (2016). Data, Design and Civics: An Exploratory Study of Civic Tech. *34th Annual Chi Conference on Human Factors in Computing Systems, Chi 2016*, 2970–2981. <https://doi.org/10.1145/2858036.2858326>
- Ermoshina, K. (2018). Civic Hacking Redefining Hackers and Civic Participation. *Tecnoscienza-Italian Journal of Science & Technology Studies*, 9(1), 79–101.
- Gordon, E., & Lopez, R. A. (2019). The Practice of Civic Tech: Tensions in the Adoption and Use of New Technologies in Community Based Organizations. *Media and Communication*, 7(3), 57–68. <https://doi.org/10.17645/mac.v7i3.2180>
- Hou, Y., & Lampe, C. (2017). Sustainable Hacking: Characteristics of the Design and Adoption of Civic Hacking Projects. *Proceedings of the 8th International Conference on Communities and Technologies*, 125–134. <https://doi.org/10.1145/3083671.3083706>
- Knutas, A., Palacin, V., Maccani, G., & Helfert, M. (2019). Software Engineering in Civic Tech A Case Study about Code for Ireland. *2019 Ieee/Acm 41st International Conference on Software Engineering: Software Engineering in Society (Icse-Seis 2019)*, 41–50. <https://doi.org/10.1109/ICSE-SEIS.2019.00013>
- Majorek, M., & du Vall, M. (2017). Civic technology for education: Analysis and evaluation of selected initiatives. In E. Masal, I. Onder, S. Besoluk, H. Caliskan, & E. Demirhan (Eds.), *Erpa International Congresses on Education 2017 (erpa 2017)* (Vol. 37, p. 01015). E D P Sciences. <https://doi.org/10.1051/shsconf/20173701015>
- May, A., & Ross, T. (2018). The design of civic technology: Factors that influence public participation and impact. *Ergonomics*, 61(2), 214–225. <https://doi.org/10.1080/00140139.2017.1349939>
- Moore, J. (2020). Towards a more representative politics in the ethics of computer science. *Proceedings of the 2020 Conference on Fairness, Accountability, and Transparency*, 414–424. <https://doi.org/10.1145/3351095.3372854>
- Song, C., & Lee, J. (2016). Citizens' Use of Social Media in Government, Perceived Transparency, and Trust in Government. *Public Performance & Management Review*, 39(2), 430–453. <https://doi.org/10.1080/15309576.2015.1108798>
- Skarzauskiene, A., & Maciuliene, M. (2020). Mapping International Civic Technologies Platforms. *Informatics-Basel*, 7(4), 46. <https://doi.org/10.3390/informatics7040046>
- Stiver, A., Barroca, L., Petre, M., Richards, M., & Roberts, D. (2015). Civic crowdfunding: How do offline communities engage online? *British Hci 2015*, 37–45. <https://doi.org/10.1145/2783446.2783585>

Yoshida, M., & Thammetar, T. (2021). Education Between GovTech and Civic Tech. *International Journal of Emerging Technologies in Learning*, 16(4), 52–68.
<https://doi.org/10.3991/ijet.v16i04.18769>