# CRAFTING EFFECTIVE NSF BROADER IMPACTS STATEMENTS

GRAND VALLEY STATE UNIVERSITY

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# PRESENTER

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**GRANTS CONSULTANT**

### TOTAL WINS

**$15+**

**MILLION**

Grant funding for Hanover clients

### AGENCY EXPERTISE

- Materials science background in ceramics, concrete, water chem, and rare earths with focus on environmental sustainability
- Proposal writer and manager for IT services and technology companies
- Specializes in public sector proposals and grants

### On a Personal Note...

- Taekwondo Enjoyer
- Volunteering Enjoyer
- Likes Organization

# GENERAL

# Summary of Broader Impacts Statements

A well-developed Broader Impacts statement strengthens proposals and maximizes real-world applications in CSE fields.

- **Purpose:**
  - Demonstrate how computer science and engineering (CSE) research benefits society beyond academic knowledge.

- **Key Areas:**
  - Societal: Cybersecurity, AI ethics, environmental sustainability, education, policy.
  - Technological: New software, automation, hardware advancements, data privacy.
  - Economic: Workforce development, entrepreneurship, industry collaboration.
  - Education & Research Integration: Training, mentorship, interdisciplinary innovation.
  - Implementation & Evaluation: Measurable outcomes and institutional support.

# Importance of Broader Impacts

Broader Impacts are essential for demonstrating the societal relevance and applicability of CSE research within and beyond academia.

- NSF evaluates proposals on two criteria: Intellectual Merit and Broader Impacts.
- Broader Impacts describe how research benefits society beyond academic knowledge.
- Must be concrete, feasible, and measurable.

# Structuring Your Broader Impacts Statement

A well-structured statement ensures clarity, impact, and alignment with NSF priorities and CSE research goals.

- Introduction & Overview
- Societal Broader Impacts
- Technological Broader Impacts
- Economic Broader Impacts
- Integration of Education and Research
- Implementation & Evaluation
- Conclusion

# Introduction & Overview

Clearly define the link between your research and its broader impacts to establish a strong foundation and relevance for academic funding in CSE.

- Summarize how your research connects to broader societal needs.
- Identify specific challenges your work addresses (e.g., AI fairness, cybersecurity threats, sustainability in computing, workforce automation).
- Ensure alignment with NSF's mission and national priorities.

# Societal Broader Impacts

Addressing societal challenges through CSE research ensures a safer, more ethical, and sustainable digital future.

- **Cybersecurity & Data Privacy:**
  - Advancing secure computing to protect personal and governmental data.
- **AI & Ethics:**
  - Ensuring responsible AI development and mitigating bias in machine learning models.
- **Environmental Sustainability:**
  - Energy-efficient computing, green data centers, and sustainable software engineering.
- **STEM Education & Outreach:**
  - Increasing participation in computing fields
- **Policy & Governance:**
  - Informing government regulations on AI, data privacy, and digital security.

# Technological Broader Impacts

Technological advancements in CSE drive innovation across industries and contribute to open, accessible computing solutions.

- **Innovative Software & Algorithms:**
  - Developing faster, more efficient computing models and AI techniques.
- **Automation & Robotics:**
  - Enhancing industrial automation, smart manufacturing, and intelligent systems.
- **Open Source Contributions:**
  - Providing open datasets, frameworks, and tools for global scientific collaboration.
- **Advancing Network & Computing Infrastructure:**
  - Enhancing cloud computing, edge computing, and secure communication protocols.
- **Human-Computer Interaction (HCI):**
  - Improving accessibility and usability of computing technologies for diverse populations.

# Economic Broader Impacts

Economic benefits from CSE research include job creation, tech industry growth, and a highly skilled workforce.

- **Workforce Development:**
  - Training students and professionals in emerging computing technologies.
- **Entrepreneurship & Startups:**
  - Supporting commercialization of new computing innovations and fostering tech startups.
- **Industry Partnerships:**
  - Collaborating with companies to translate research into real-world applications.
- **Efficiency & Cost Reduction:**
  - Developing software and hardware solutions that improve industrial productivity and reduce costs.
- **Job Market & Future Skills:**
  - Addressing the demand for AI specialists, cybersecurity professionals, and software engineers.

# Integration of Education and Research

Integrating education into computing research strengthens academic programs and ensures knowledge transfer to the next generation of innovators.

- **Project-Based Learning:**
  - Incorporate research findings into computing curricula through hands-on coding and development projects.
- **Mentorship & Training:**
  - Establish structured mentorship programs for students, guiding them through research-based learning.
- **Interdisciplinary Collaboration:**
  - Connect computing research with fields like medicine, environmental science, and finance.
- **K-12 & Public Engagement:**
  - Develop coding bootcamps, AI ethics workshops, and cybersecurity awareness programs.
- **Access for Underrepresented Socioeconomic Groups:**
  - Expand opportunities in computing education for students from low-income and resource-limited backgrounds, ensuring access to training and research experiences.

# Implementation & Evaluation Plan

A structured implementation plan with clear evaluation metrics strengthens the credibility of your broader impacts statement in CSE research.

- **How will you implement these impacts?**
  - Industry collaborations, open-source contributions, public outreach, educational programs.
- **How will success be measured?**
  - Metrics such as publications, software adoption, patents, workforce training outcomes.
- **Institutional Support & Resources**
  - Tech incubators, NSF-funded research centers, interdisciplinary computing initiatives.

# Final Thoughts

A well-crafted Broader Impacts statement enhances funding potential, research relevance, and career advancement for CSE researchers.

- Be specific – avoid vague claims.
- Demonstrate feasibility – show concrete steps for impact realization.
- Include measurable outcomes – track adoption, workforce development, and policy contributions.
- Ensure integration with research – align broader impacts naturally with technical advancements.


STAKEHOLDER ORIENTED

# Understanding Stakeholder-Centered Broader Impacts

A stakeholder-focused approach ensures broader impacts are relevant, targeted, and actionable.

- **Purpose:**
  - Identify and structure broader impacts based on key stakeholder groups.
- **Stakeholder Groups:**
  - Academia: Faculty, students, and research institutions.
  - Industry: Tech companies, startups, and workforce development.
  - Government & Policy Makers: Regulatory bodies and public sector agencies.
  - Society & Public Engagement: General public, underserved communities, and K-12 education.
- **Example:**
  - A research project on AI ethics can engage academia through scholarly publications, industry via responsible AI practices, government in policy recommendations, and society through public awareness campaigns.

# Academic Stakeholders

Broadening research opportunities and academic collaboration drives innovation and knowledge dissemination.

- **Enhancing Research & Education:**
  - Strengthen interdisciplinary research collaborations.
  - Develop new curricula integrating emerging technologies.
  - Increase accessibility to research datasets and tools.
- **Training the Next Generation:**
  - Support graduate and undergraduate research opportunities.
  - Establish mentorship programs for early-career researchers.
- **Example:**
  - A collaborative research initiative in computer vision develops an open-access dataset for academic use, integrates findings into graduate-level coursework, and provides research assistantships for students interested in AI applications.

# Industry & Workforce Development

Connecting academia and industry fosters job creation, innovation, and economic gr

- **Technology Transfer & Commercialization:**
  - Develop partnerships with industry to translate research into real-world applications.
  - Facilitate open-source software and hardware contributions.
- **Preparing a Skilled Workforce:**
  - Create industry-relevant educational programs and certifications.
  - Provide hands-on training in cybersecurity, AI, and software engineering.
- **Strengthening Startups & Entrepreneurship:**
  - Support researchers in launching startups based on their innovations.
- **Example:**
  - A research team developing AI-powered cybersecurity solutions collaborates with tech firms to integrate their models into enterprise security products and trains students in cybersecurity best practices.

# Government & Policy Makers

CSE research can shape policies and improve governance through evidence-based insights.

- **Informing Public Policy:**
  - Provide data-driven insights to support AI governance, cybersecurity regulations, and digital privacy laws.
- **Public Sector Applications:**
  - Enhance government infrastructure with cutting-edge computing solutions.
  - Improve efficiency in public services through data analytics and automation.
- **National Security & Cybersecurity:**
  - Collaborate with government agencies to strengthen national cybersecurity defenses.
- **Example:**
  - A machine learning research lab collaborates with government agencies to develop AI-driven models that improve early detection of cybersecurity threats in critical infrastructure.

# Society & Public Engagement

Engaging the public builds trust and ensures equitable access to technological advancements.

- **STEM Outreach & K-12 Education:**
  - Develop programs to introduce coding and computational thinking in early education.
  - Engage underrepresented socioeconomic groups in computing fields.
- **Public Awareness & Science Communication:**
  - Use media, podcasts, and public talks to make research accessible to a broader audience.
- **Ethical AI & Digital Literacy:**
  - Promote responsible AI development and digital privacy awareness.
- **Example:**
  - A university AI lab runs free community workshops on understanding and mitigating algorithmic bias in everyday technology.

# Implementation & Evaluation

A structured approach to implementation ensures broader impacts are sustainable and measurable.

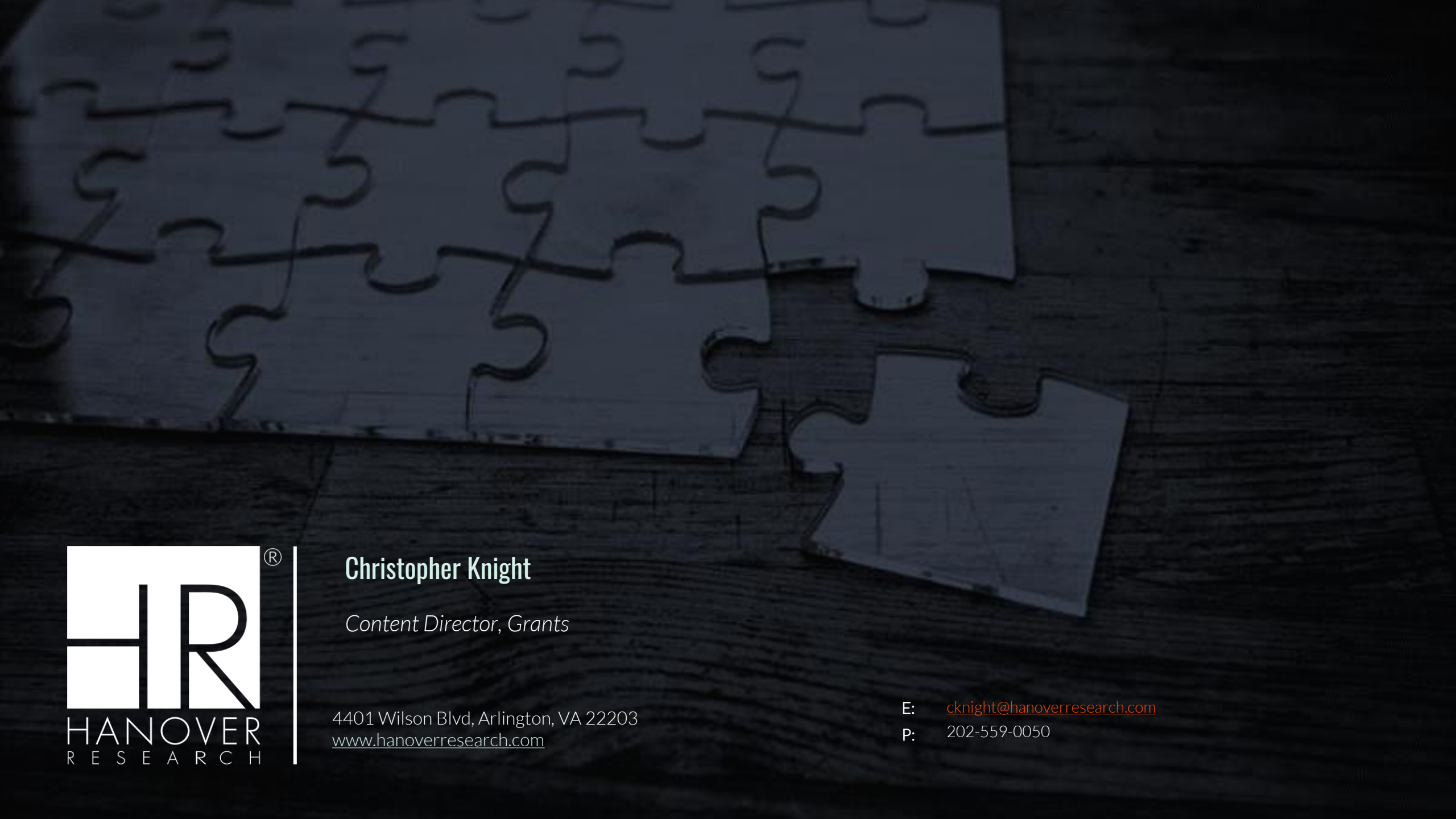
- **How will these broader impacts be implemented?**
  - Collaboration with stakeholders through industry consortia, education programs, and policy initiatives.
- **Measuring Success:**
  - Track engagement metrics (student participation, industry partnerships, policy adoption).
  - Assess societal impact through outreach participation and accessibility improvements.
- **Institutional Support & Resources:**
  - Leverage NSF-funded research centers, public-private partnerships, and community engagement programs.
- **Example:**
  - A data ethics research team creates an open-access repository for policymakers to access AI transparency guidelines and best practices.

# Final Thoughts

A stakeholder-driven approach to broader impacts leads to meaningful contributions in CSE research.

- Addressing the needs of diverse stakeholders strengthens NSF broader impacts.
- Align research outcomes with societal, economic, and technological needs.
- Foster cross-sector collaborations to maximize long-term impact.
- **Example:**
  - A project on climate-friendly computing integrates efforts across academia, tech industry leaders, policymakers, and public engagement through educational campaigns.


QUESTIONS?

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