BOARD OF TRUSTEES' RESEARCH AND ECONOMIC DEVELOPMENT COMMITTEE AGENDA AND MATERIALS

March 22, 2023
1:00 – 3:00 p.m.

AGENDA
RESEARCH AND ECONOMIC DEVELOPMENT COMMITTEE
March 22, 2023
1:00 p.m. - 3:00 p.m.

Regular Meeting:

1. RED Division updates — Parag Chitnis
2. CHIPs and Science Act Committee Report — James Ahern
3. Chat-bots and research enterprise — Parag Chitnis
4. Innovation Engine Application — Steve Farkas

RED Project Presentations

5. WIHR and Humanities research — Scott Henkel
    a. Students will present research presentations supported by WIHR seed funding.
        i. Katelyn Dale Smith
        ii. Gerald Henderson
        iii. Skylar Cooper
        iv. Cecilia Curiel
        v. Liam Leslie

RESEARCH AND ECONOMIC DEVELOPMENT COMMITTEE
COMMITTEE MEETING MATERIALS

AGENDA ITEM TITLE: RED Division Updates – Parag Chitnis

☒ PUBLIC SESSION
☐ EXECUTIVE SESSION

PREVIOUSLY DISCUSSED BY COMMITTEE:
- ☒ Yes
- ☐ No

FOR FULL BOARD CONSIDERATION:
- ☐ Yes *[Note: If yes, materials will also be included in the full UW Board of Trustee report.]*
- ☒ No

☒ *Attachments/materials are provided in advance of the meeting.*

EXECUTIVE SUMMARY:
VP Chitnis will provide verbal updates regarding work within the Division, to include the following topics:

- Communication and marketing plans: New staffing and a plan focused on strategic strengths of UW will allow UW to highlight its success and impacts.
- Enhanced help with grant-writing: To increase size and breadth of research enterprise, several activities are implemented and planned.
- WIP update (phase 2): WIP proposals for Phase 2 were invited by the Governor's office. An update will be provided.

PRIOR RELATED BOARD DISCUSSIONS/ACTIONS:

WHY THIS ITEM IS BEFORE THE COMMITTEE:
Informational update

ACTION REQUIRED AT THIS COMMITTEE MEETING:
N/A

PROPOSED MOTION:
N/A

RESEARCH AND ECONOMIC DEVELOPMENT COMMITTEE
COMMITTEE MEETING MATERIALS

AGENDA ITEM TITLE: CHIPS and Science Act Committee Report – James Ahern

☒ PUBLIC SESSION
☐ EXECUTIVE SESSION

PREVIOUSLY DISCUSSED BY COMMITTEE:
- ☒ Yes
- ☐ No

FOR FULL BOARD CONSIDERATION:
- ☒ Yes *[Note: If yes, materials will also be included in the full UW Board of Trustee report.]*
- ☐ No

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EXECUTIVE SUMMARY:
On August 2, 2022, the **CHIPS and Science Act of 2022** was signed into law. This law incorporates two components: appropriations to support semiconductor industry, including some innovation and workforce development activities, and authorizations for the budgets of science agencies, including NSF, DOE, NASA, and others. It culminates extensive negotiations and grass root efforts in ensuring substantial increases in authorized budgets for the Federal Science agencies while making their programs responsive to the needs of diverse institutions, particularly those in the EPSCoR states and in low-population states. This law provides significant opportunities for university-based research and innovation efforts.

On October 18, 2022, President Seidel charged CHIPs and Science Act Working Group to analyze both acts and identify opportunities for UW faculty and students. The group was also tasked to pinpoint actions to be taken by UW to prepare for these opportunities, develop a timeline and identify budgetary needs. The Group is composed of faculty across the University and two administrators (Dean Ahern and VP Chitnis). The working group met biweekly, starting with a primer on Federal laws governing authorizations and appropriations and the landscape of Federal Science agencies. The subsequent meetings led to surveys for incorporating broad faculty participation. The survey results will be incorporated in the revisions of this draft. VP Chitnis and Dean Ahern will provide a summary of the preliminary report of the Working Group.

PRIOR RELATED BOARD DISCUSSIONS/ACTIONS:

WHY THIS ITEM IS BEFORE THE COMMITTEE:
Informational

ACTION REQUIRED AT THIS COMMITTEE MEETING:
N/A

PROPOSED MOTION:
N/A

RESEARCH AND ECONOMIC DEVELOPMENT COMMITTEE
COMMITTEE MEETING MATERIALS

AGENDA ITEM TITLE: Chat-bots and the research enterprise – Parag Chitnis

☒ PUBLIC SESSION
☐ EXECUTIVE SESSION

PREVIOUSLY DISCUSSED BY COMMITTEE:
- ☐ Yes
- ☒ No

FOR FULL BOARD CONSIDERATION:
- ☐ Yes *[Note: If yes, materials will also be included in the full UW Board of Trustee report.]*
- ☒ No

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EXECUTIVE SUMMARY:

Chat-bots based on generative AI are impacting university function in different ways. An update will be provided to the committee about the impact of these tools on formulating research, conducting research and reporting research results.

PRIOR RELATED BOARD DISCUSSIONS/ACTIONS:
N/A

WHY THIS ITEM IS BEFORE THE COMMITTEE:
Informational

ACTION REQUIRED AT THIS COMMITTEE MEETING:

N/A

PROPOSED MOTION:

N/A

Chat-GPT and Research Enterprise[1]

Chat-GPT (generative pre-trained transformer) uses generative AI

Generative AI is a type of artificial intelligence that is used to create or generate new content, such as images, music, text, or video. Unlike other forms of AI, such as supervised learning or reinforcement learning, which are designed to make predictions or classifications based on existing data, generative AI is designed to generate new data that is similar to existing data.

Generative AI models are typically based on deep learning neural networks, which are trained on large datasets of examples. During training, the model learns to identify patterns and relationships in the input data and can then use this knowledge to generate new data that resembles the training data.

There are several types of generative AI models, including:

1. Variational Autoencoders (VAEs): VAEs are generative models that learn to encode the input data into a latent space representation, which can then be used to generate new data that resembles the input data.
2. Generative Adversarial Networks (GANs): GANs are generative models that consist of two neural networks: a generator network that generates new data, and a discriminator network that evaluates the quality of the generated data.
3. Autoregressive models: Autoregressive models generate new data by predicting the probability distribution of the next data point based on the previous data points.

Generative AI has many applications in various fields, including art, music, and design, and has the potential to revolutionize many industries, such as fashion, entertainment, and advertising.

Generative AI and Research

Generative AI has had a significant impact on research formulation, implementation, and publication. Here are some key ways it has influenced these areas:

1. Research Formulation: Generative AI has enabled researchers to generate new ideas and hypotheses more efficiently. For example, researchers can use generative models to explore different scenarios and generate new data that can help them formulate research questions and hypotheses. This can lead to more informed and innovative research proposals.
2. Research Implementation: Generative AI has also enabled researchers to conduct experiments and analyze data more efficiently. For example, generative models can be used to simulate complex systems and generate large amounts of data that can be used to train machine learning algorithms. This can help researchers to analyze data faster and more accurately.
3. Publication: Generative AI has also impacted the publication process by enabling researchers to create high-quality visuals and graphics for their papers. For example, researchers can use generative models to create 3D visualizations of data or to generate realistic images of complex systems. This can help to convey research findings more effectively and make them more accessible to a wider audience.

Overall, generative AI has enabled researchers to explore new ideas, conduct experiments more efficiently, and communicate their findings more effectively. As AI continues to advance, it is likely that it will have an even greater impact on research in the future.

Concerns over using generative AI in research

There are several concerns about using generative AI in research, including:

1. Ethical concerns: Generative AI has the potential to create false or misleading information that could harm individuals or society. For example, generating fake news or deepfakes can cause social unrest and confusion.
2. Bias: Generative AI models can learn and perpetuate existing biases and inequalities in data. This can have real-world consequences, such as reinforcing gender, racial or socioeconomic stereotypes.
3. Limited interpretability: Generative AI models can be highly complex and difficult to interpret, which can make it challenging to understand how the models are generating their output.
4. Overfitting: Generative AI models may generate highly realistic and specific samples but can be prone to overfitting to the training data, meaning that the model may not generalize well to new data.
5. Data privacy: Generative AI models may be trained on sensitive data, such as medical or financial information, which raises concerns about data privacy and security.
6. Reproducibility: There are concerns about the reproducibility of results obtained through generative AI models. The lack of standardization and transparency in model architecture, hyperparameters, and training data make it challenging to compare results between studies.

Overall, researchers must consider these concerns when using generative AI models in their research and take steps to address them. This may include being transparent about the data used to train the model, carefully evaluating the model's performance, and considering the ethical implications of the generated output.

Generative AI and Research Integrity

Generative AI presents several challenges to research integrity considerations, particularly with respect to the reproducibility and transparency of research results.

One of the primary challenges with generative AI is that it can be difficult to reproduce results obtained using generative AI models. Generative AI models are often highly complex and can have many hyperparameters that can affect the output. As a result, it can be challenging to replicate the exact settings used to train a generative AI model, which can make it difficult to reproduce results obtained using that model.

Another challenge with generative AI is that it can be difficult to interpret how the model arrived at its output. Unlike other forms of AI, such as supervised learning or reinforcement learning, where the output is a result of a clearly defined process, the output of generative AI is often the result of complex interactions within the model. This can make it difficult to understand how the model arrived at a particular output, which can raise concerns about the validity and reliability of the results.

Finally, there are ethical considerations associated with the use of generative AI in research. Generative AI models can be used to create realistic-looking images, videos, and other content that can be used to deceive people. This raises concerns about the potential for misuse of generative AI, such as the creation of fake news or the spread of disinformation.

To address these challenges, researchers using generative AI must be transparent about the methods used to train their models and provide detailed descriptions of the model architecture, training data, and hyperparameters used. They must also provide access to the code and data used in their research to facilitate reproducibility. Additionally, researchers must be aware of the ethical considerations associated with the use of generative AI and must take steps to ensure that their research is conducted responsibly.

Funding agencies and generative AI

Funding agencies have recognized the potential of generative AI in advancing scientific research and have started to provide support for research projects that use this technology. Many funding agencies have established specific funding programs that focus on the use of AI, including generative AI, in research.

For example, the National Science Foundation (NSF) in the United States has launched several funding programs that support research using AI, including the "AI Institute for Foundations of Machine Learning" and "AI Institute for Artificial Intelligence and Fundamental Interactions". These programs aim to support research projects that use AI, including generative AI, to advance scientific understanding in various fields.

Similarly, the European Commission has launched the "AI for Science" initiative, which aims to support the development and use of AI technologies in scientific research. The initiative provides funding for research projects that use AI to advance scientific understanding in various areas, including physics, biology, and chemistry.

Funding agencies have also recognized the importance of addressing ethical concerns related to the use of generative AI in research. Some funding agencies have established specific requirements for researchers to address ethical considerations when using generative AI, such as the potential for bias or the misuse of generated content.

Overall, funding agencies have responded positively to the use of generative AI in research and have established funding programs to support research projects using this technology. However, these agencies also recognize the importance of addressing ethical concerns related to the use of generative AI in research and have established guidelines to ensure that research projects using generative AI are conducted responsibly.

Scientific journals and generative AI

The use of generative AI in research is a relatively new area, and scientific journals are still adapting to this emerging technology. However, some scientific journals have already started to publish papers that use generative AI, particularly in fields such as computer science, mathematics, and physics.

The response of scientific journals to the use of generative AI in research has been mixed. Some journals have recognized the potential of generative AI to advance scientific knowledge and

have been receptive to publishing papers that use generative AI. Other journals have been more cautious and have raised concerns about the validity and reproducibility of results obtained through generative AI models.

To address these concerns, some scientific journals have implemented guidelines and requirements for the publication of papers that use generative AI. For example, some journals require that authors provide detailed descriptions of the generative AI models used in their research, including the model architecture, training data, and hyperparameters. Other journals require authors to make their code and data publicly available to facilitate reproducibility.

Overall, the scientific community is still exploring how best to use generative AI in research, and scientific journals are adapting to these changes. As the use of generative AI continues to grow, it is likely that scientific journals will develop more standardized approaches to evaluating and publishing papers that use this technology.

[1] All content of this report except for the titles (in blue and bold font) were generated by Chat-GPT

RESEARCH AND ECONOMIC DEVELOPMENT COMMITTEE

COMMITTEE MEETING MATERIALS

AGENDA ITEM TITLE: Innovation Engine Application – Steve Farkas

☒ PUBLIC SESSION
☐ EXECUTIVE SESSION

PREVIOUSLY DISCUSSED BY COMMITTEE:
- ☐ Yes
- ☒ No

FOR FULL BOARD CONSIDERATION:
- ☐ Yes *[Note: If yes, materials will also be included in the full UW Board of Trustee report.]*
- ☒ No

☒ *Attachments/materials are provided in advance of the meeting.*

EXECUTIVE SUMMARY:
Rural regions are severely disadvantaged in economic growth and prosperity, primarily because of the lack of knowledge-based innovation that spurs new businesses and grows and attracts modern industry. To revitalize this often-neglected sector of American society, SHIFTR will focus initially on Wyoming(WY), an underserved rural state. The proposed NSF engine will catalyze computing and technology-based economic development with a novel network model designed for rural communities with no urban center, building on WY's existing partnerships across virtually all education, business and economic development and government organizations. SHIFTR is fundamentally about broader impacts. It will expand and integrate a network of innovation hubs across rural and diverse communities in WY. AVP Farkas will provide a summary of the application.

PRIOR RELATED BOARD DISCUSSIONS/ACTIONS:
N/A

WHY THIS ITEM IS BEFORE THE COMMITTEE:
Informational

ACTION REQUIRED AT THIS COMMITTEE MEETING:

N/A

PROPOSED MOTION:

N/A

Overview

NSF Engines: Type-2: Sustainable/Scalable High-Plains Innovation for Transforming Rural America (SHIFTR)

Steve Farkas, University of Wyoming, Laramie, WY

Purpose and Vision: Rural regions are severely disadvantaged in economic growth and prosperity, primarily because of the lack of knowledge-based innovation that spurs new businesses and grows and attracts modern industry. To revitalize this often-neglected sector of American society, SHIFTR will focus initially on Wyoming (WY), an underserved rural state. Innovation will be (a) driven by use-inspired research in computing and technology as it applies to traditional and new market sectors important in WY, and (b) supported by strengthening industry partnerships and expanding a distributed rural network of innovation hubs. Aligning all the state's higher education institutions (University of Wyoming (UW) and community colleges), K-12 schools, state government and industry, and building on extraordinary state support, SHIFTR will create new jobs, transforming traditional industry sectors and seeding emerging industries for the future. SHIFTR will drive economic prosperity for rural communities across WY, with a network model designed to apply to other rural regions faced with similar challenges.

Intellectual Merit: The proposed NSF engine will catalyze computing and technology-based economic development with a novel network model designed for rural communities with no urban center, building on WY's existing partnerships across virtually all education, business and economic development and government organizations. Driving economic diversification/modernization, computationally-based transdisciplinary use-inspired research using data, artificial intelligence, automation, and robotics will be the foundation for innovation and workforce development and retention. Traditional industries, e.g., energy and mining, face scrutiny and environmental pressures. Agriculture and ranching experience significant challenges while tourism and outdoor recreation are threatened by climate change. SHIFTR will support use-inspired research projects to pioneer digital and technological approaches in these traditional industries to make them sustainable economically and environmentally. Use-inspired research will also spur new industries in clean energy and in blockchain and computing technologies. To accelerate commercialization, a deeply connected system of innovation hubs will be expanded and fostered through partnerships across the entire state, centered on community colleges and communities, further supported by industry and state governments.

Broader Impacts: SHIFTR is fundamentally about broader impacts. It will expand and integrate a network of innovation hubs across rural and diverse communities in WY. These hubs will enhance corporate engagement and internship networks, modernize existing industry, and support growth of new businesses, in new market sectors across WY, growing its economy. UW, all eight community colleges (including a tribal-serving college), schools, local governments and economic development organizations, and state agencies will collaborate to build this robust innovation ecosystem. Statewide programs at all levels of the educational pipeline will build new skills in computing and technology needed for innovation, growing WY's knowledge-based workforce across all areas of our diverse and underserved rural communities, including the tribal and Latinx communities and youth. Connections with partners outside WY will expand efforts to other rural areas, broadening impact. SHIFTR truly has potential to transform rural American economies, bridging an important gap in knowledge-based innovation.

Keywords: Rural Innovation, Digital industry, Agricultural technology, Energy Innovation, Environmental Services

LOI ID (required): L23- 000150 Concept Outline ID (required): INQ-22- 00998).

RESEARCH AND ECONOMIC DEVELOPMENT COMMITTEE
COMMITTEE MEETING MATERIALS

AGENDA ITEM TITLE: Presentation - WIHR and Humanities Research – Scott Henkel

☒ PUBLIC SESSION
☐ EXECUTIVE SESSION

PREVIOUSLY DISCUSSED BY COMMITTEE:
- ☐ Yes
- ☒ No

FOR FULL BOARD CONSIDERATION:
- ☐ Yes *[Note: If yes, materials will also be included in the full UW Board of Trustee report.]*
- ☒ No

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EXECUTIVE SUMMARY:
The Research and Economic Development Division is committed to increasing the breadth and size of UW's research enterprise. As a result of this commitment, research on humanities will be presented to highlight examples of exciting work and scholarly achievements in humanities research.

PRIOR RELATED BOARD DISCUSSIONS/ACTIONS:
N/A

WHY THIS ITEM IS BEFORE THE COMMITTEE:
Informational

ACTION REQUIRED AT THIS COMMITTEE MEETING:

N/A

PROPOSED MOTION:

N/A