Entrepreneurship—Innovation Pillar
Draft Report
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Report format:

- Charge
- Model Considerations
- UW Innovation Hub
- Reports from the four working groups

Charge:

- Address enhancing the ability and incentives for our faculty and staff to raise additional revenue streams from grants, licenses, gifts, corporate partnerships, etc.
- Address activities that support value creation around new businesses, from educational offerings for students and postdocs through faculty starting companies. These activities should support existing economies in Wyoming (e.g., Agriculture, Energy, Tourism, Extraction) and new economies to be developed (e.g., Blockchain, AI, technologies, and applications across markets)
- Explore programs, infrastructure and organizational structures needed to build out innovation and entrepreneurship, pivoting UW to financial sustainability and accelerating its role as an economic development engine
- Explore creation of a UW Center for Entrepreneurship and Innovation (CEI) that could connect activities across the university, and provide a centerpiece for these activities. A corporate partners program and UW Research Park need to be explored as well.

Model Considerations:

- Efficiently leverages existing resources, easy to understand and engage, generates mutual value for stakeholders
- Interdisciplinary integrator
- Centralized coordination with students highly engaged in experiential, applied learning
- Supports emergent and existing businesses with developed partnership programs
- Incorporates incentive systems to remove internal participation barriers
- Mechanisms for accessing capital and generating new revenue streams
- Statewide resource for Wyoming Innovation Network and aligned with the state's priority economic sectors (Agriculture, Tourism, Energy and Technology)

UW Innovation Hub … Wyoming's Cornerstone for Entrepreneurship and Innovation

Specifically related to a centralized approach to programmatic execution, is the concept of developing a "UW Innovation Hub"; a Hub that efficiently coordinates activities related to entrepreneurship education and applied innovation in an interdisciplinary environment actively supported by the business community. An environment that is conducive to educating, training and practicing skills demanded by today's marketplace and made available to all students, faculty and staff. The Hub will be a conduit for resources that enable innovative, entrepreneurial and intrapreneurial skills to support exiting businesses as well as catalyze new businesses creation that contributes to the state's economic diversification agenda. The Hub will be governed by a committee comprised of designated leadership from UW, community colleges, Wyoming Business Council, investor community, and corporate partners.

Many students do not see themselves as entrepreneurs or innovators. They need to be introduced to an ecosystem that cultivates their ideas and assists with exploration of the "what if?":

- Artists and designers who shape our products;
- Business managers who guide new innovative start-up companies;
- Authors and film-makers creating new worlds to enchant, and developers making games to engage, millions of people around the world;
- Fashion designers creating innovative apparel with functional fabrics;
- Social scientists and cultural anthropologist partnering with innovators to create solutions for other cultures;
- Students acquiring a science and engineering education dreaming about what they will create and mentors showing them the way[1]

It is envisioned that the Hub will facilitate, in collaboration with its private business partners, interdisciplinary student and faculty team projects that tackle challenges of strategic significance and present their innovative recommendations to business leadership. Interdisciplinary teams will scope and define desired company deliverables, conduct research, perform analysis, and collaborate with business partners to advance relevant solutions. Students will acquire highly marketable interdisciplinary team-based problem solving skills while faculty are presented with a real-time laboratory for research with opportunities for future sponsored research activities.   Additional value-adds include student internships and graduate recruitment.

Concurrent with experiential learning opportunities, UW stakeholders will have access to the Hub's business incubators and makerspace resources to further new business ideation, creation, and market commercialization, to include pitch events, state-wide entrepreneurial networking, and access to capital. It is envisioned UW's Cirrus Park asset will become an extension of business incubator activities to enable a community of large and small companies

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[1] Council on Competitiveness, Competing in the Next Economy – The New Age of Innovation

that expands faculty and student interactions to enhance research, curriculum, and industry engagement (proposed research park).

In addition to start-up business activities, the HUB will afford early stage businesses access to UW's state-wide business resource network as well as a team of world-class business and economic analysts. Conceptually, the Hub becomes a one-stop shop for new business creation, existing business sustainability, and key contributor to Wyoming's economic vitality.
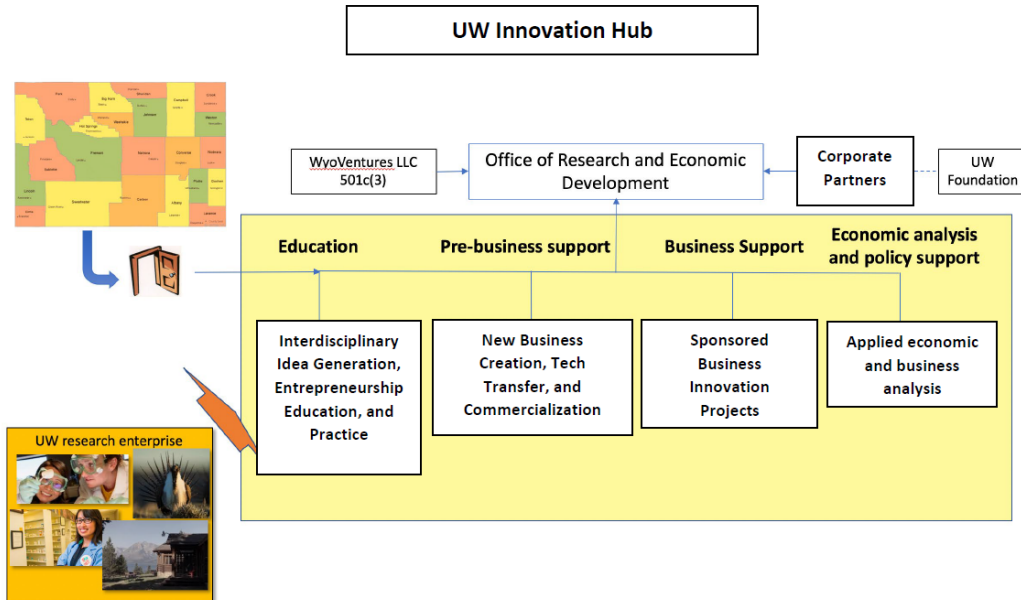
Working Group 1: Expanding Existing and New Funding Sources

Members of the Entrepreneurial/Innovation Pillar's Working Group 1 were tasked with developing a plan to maximize existing and new funding sources. Members of Working Group 1 include Ben Cook, Patrick Kreiser, Leslie Rush, David Sprott, and Neil Theobald. This draft report provides a set of ideas developed by the group for use by the Entrepreneurial/Innovation Pillar and others at UW.

As one of the leading land grant research institutions in the United States, the University and its faculty excel in business, engineering, humanities, biological sciences, and the arts. Among 341 public universities in the U.S., the *Wall Street Journal* ranks UW 65th (81st percentile); among UW's peers, only Washington State University (54th) is ranked higher.

The University of Wyoming is a leader in fostering multidisciplinary research and in forming partnerships with business, industry, government, and other academic institutions that lead to important research and development and economic growth. Grants and awards to the UW for research and other sponsored programs increased 5.6 percent in the 2019-20 fiscal year to a record total of $99.4 million.

The second component of UW's mission is workforce development, which is critical in maintaining and expanding economic development in Wyoming. UW President Edward Seidel is seeking to create new academic programs and new university priorities (i.e., to be more digital, entrepreneurial, inclusive, and interdisciplinary). A major challenge, though, is how to bring these practices to scale. This is particularly an issue in a biennium in which UW's state funding is being cut by $74.4 million or 15 percent.

How can UW provide incentives for faculty and remove barriers to their participation in additional revenue-generating actions, in research, workforce development, and development of additional fund sources such as grants, licenses, corporate partnerships, gifts, and others?

Research

Working Group 1 first examined potential for expansion of research funding, which leads to innovation and is critical to creating new economic opportunities. Recent University's efforts to spur economic growth in Wyoming involve:

- Financial support for researchers/inventors to get ideas/products to marketplace, and
- Development of a single portal for entrepreneurs and inventors to access the UW Business Resource Center and WBC.

The Office of Research and Economic Development (ORED) at the University of Wyoming has overall administrative responsibility for developing, coordinating, and stimulating research and creative activity at UW. What steps should the Vice President for Research and Economic

Development be taking to increase and diversify research and creative works, extramural funding, public-private partnerships, and technology transfer?

- Development of university-wide or unit-specific gift and grant funds for faculty start-up packages; we recommend consideration of connecting start-up cost provisions to a payback from grant funding – a contract, of sorts, between ORED and a faculty member.
- Instantiation of internal research funding initiatives, facilitating development of research space and research staff;
- Significantly stronger staffing in the Office of Research and Economic Development than currently exists, in both pre- and post-award support;
- Development of a job-sharing structure (like that currently used in Institutional Marketing) among ORED, units with administrator/staff positions dedicated to the enterprise of research, and units without such positions;
- A clear policy related to indirect cost distribution that would incentivize faculty for more grant engagement.
- Flexibility on utilizing grant awards for temporary salary increases, and removal of caps on supplemental pay. Currently faculty can "max out" on the allowable 3-months of supplemental pay and are not always aware of tools that may be available to receive the full benefits of grant awards.
- Consider adding an explicit Excellence in Research workload adjustment criteria for faculty that are able to fund graduate assistantships on external awards, even if the award itself falls under normal research activity for the faculty member.

Workforce Development

Recent efforts in this area include the following:

- A new financial aid strategy that emphasizes in-state student scholarships,
- Increasing 4-year graduation rates (UW set record of 31% in 2020) because Wyoming's primary financial aid system (the Hathaway Scholarship) provides a maximum of 8 semesters of funding,
- Partnering with the community colleges to create a Common Transcript,
- New degree offerings directly tied to Wyoming economy (3+1 teaching certificate in vocational education - - in partnership with the Wyoming Community Colleges, tourism and hospitality, construction management, computer science Blockchain certification, and an online accounting degree).

Across Wyoming, though, there is extensive debate as to whether the UW and community colleges are providing what the state needs in terms of workforce development. Increasingly, Wyoming's leaders are asking whether the state's higher education system is educating students for the right jobs. The U.S. Department of Labor reports that despite a national unemployment rate that remains at 6.2%, at least 3 million job vacancies remain unfilled. A recent survey by ManpowerGroup, a leading American human resources consulting firm, found that 49% of employers in the U.S. are frustrated at not finding employees with the required skills.

The Vice President for Research and Economic Development shares responsibility with the Provost for developing coursework and academic initiatives across UW. What steps should the VPRED and the Provost be taking to build strong working relationships (a) within the UW community, (b) with P-12 schools and community colleges, and (c) with businesses and industries to generate tuition and fee revenue?

Working Group 1 recommends the following:

1. Re-evaluate non-resident tuition rates in light of historically strong state support for the university, state population and high school graduation rates. It is our sense (though additional data are needed) that additional enrollment must come from outside of Wyoming, and that a deep dive on a strategic approach to tuition is needed. Tuition policy should be developed for resident, non-resident, and distance students that is accompanied by enrollment targets. This strategic policy work must also take into consideration necessary changes to financial aid components, such as recent changes to the Trustees' Scholarship that prioritized Wyoming students.
2. Strategic tuition policy should include planned investments in enrollment marketing which explicitly seek out the student populations envisioned in the enrollment targets.
3. Building strong relationships with community colleges and P-12 schools is critical, and the recent work on transfer improvement such as the Transfer Success Office and the effort to get common course numbering are positive signs. The Governor's WIN project carries potential. However, close consideration should be given to the impact on tuition income when other institutions take on the larger undergraduate classes and UW thus has less tuition income from those larger classes.
4. Offer online-accessible courses that will allow those currently in the workforce (i.e. teachers, dieticians, nurses, attorneys, CPAs) to upskill and upgrade, without necessarily pursuing additional degrees. These can be considered as microcredentials, or MOOCs or the like, for a fee. This state-wide partnership for workforce development would require ongoing data collection through Wyoming business/industry (consider a regular survey, as well as requests to existing organizations and advisory boards) to determine workforce development needs; a Board of Trustees sub-committee focused on statewide engagement with business/industry, in order to funnel information back to administrators and programs; and the development of a strong relationship with the Department of Workforce Services: http://www.wyomingworkforce.org/. As UW begins to develop solid information streams about needs, a system will have to be developed to build, maintain, and revise online non-credit bearing (and possibly credit bearing) courses that could be paid for by businesses/organizations instead of by individuals, for the improvement of workforce services.
5. Curricular innovation is implied but not explicitly recognized outside of normal teaching and service expectations. This can lead to a curriculum which is slow to meet changes in the marketplace which require new skills in the workforce, and limit the creation of online courses and programs. Consider adding curricular innovations and online asynchronous course development as a workload adjustment criterion. This would allow faculty a course release to develop needed classes without expanding their workload on supplemental pay. Design fees could then be redirect to temporary lecturers for course coverage.

6. Consider altering the distribution of online course and online program revenues from Unrestricted '100' accounts which must be spent within the fiscal year, over to separate Designated '200' accounts that are distinct for these programs and can accumulate for future investment and reinvestment. Further, avoid using growth in online programs to reduce block grant allocations to those same colleges; this style of budgeting counter-acts the incentive for entrepreneurial programs and growth.

Development of Additional Funding Sources

In order to incentivize faculty to engage in fundraising through corporate partnerships and gifts, several existing problems would need to be resolved in order to make it possible, probable, or even desirable for faculty to participate.

- Is there a clear definition for entrepreneurship at UW? If the university is to be an engine for economic growth, how does that mesh with the university's current mission and vision? Is entrepreneurship always embedded in the work of education and research and community engagement? If so, how best to manage that?
- Workload and job descriptions would need to be revised so that – assuming that not every faculty member is going to be involved – those that wish to be involved in fundraising can have that as part of their job description. One potential idea is to change the course release codes to include opportunities to engage in entrepreneurship/innovation.
- Similarly, how will entrepreneurship/innovation be included/rewarded in terms of reappointment, tenure and promotion? Currently such work is not included in tenure/promotion guidelines.
- For faculty to wish to engage in entrepreneurial and innovative work, an infrastructure for such productivity would need to be built, perhaps along the same line as the Ellbogen Center for Teaching and Learning – a centralized hub of support and education for the purpose of entrepreneurship and innovation. Certainly, Impact 307 could play a role in expanding its reach to serve internally in this way, though additional funding would be required for this.
- Currently, the typical academic unit's relationship with the UW Foundation for entrepreneurship/innovation means that only the Dean is charged with fund-raising. If a wider engagement is anticipated, the UW Foundation will need to adjust to work with more faculty members. Since the Foundation has traditionally not invested the entire 4% return in the operations of the foundation, this would be an opportunity for the Foundation to more fully staff its operations.
- Intellectual property policies may need to be reexamined to ensure that incentives for both faculty and for UW are in place to engage in entrepreneurship and innovation. Same could be true for indirect policy on grants. Recommendation for provost: make sure faculty are aware of clear information on policies for both.
- Centers could serve as key locations for raising funds. Faculty affiliated with a center become fellows when they are working on particular projects, and engage in entrepreneurship, innovation, and fundraising around those projects.
- Examples of department-specific actions taken to increase revenue can be found in the Appendix. These examples might be illustrative of context-specific steps that can be taken to

increase revenue, decrease spending, or find innovative ways to manage current funding sources.

Appendix

Examples of Innovative Fund-Raising in Specific Department Contexts

School of Politics, Public Affairs, & International Studies (SPPAIS) (Stephanie Anderson)

Three main endeavors:

1. Arabic

2. Fulbright-Australia

3. Asynchronous classes

Arabic: SPPAIS partners with the Fulbright Teacher Language Assistant program (FTLA) which allows us to offer Arabic instruction for $400 a month. Our Middle Eastern studies director, Eric Nigh, supervises the Arabic instruction, but having the FTLA teach frees Eric up to teach other courses, such as Middle Eastern Politics, etc. This partnership facilitates the teaching of a national security language and is of great interest to the Wyoming National Guard. Fulbright vets the applicants and pays for their airfare, etc.

Fulbright-Australia: SPPAIS, through the Milward Simpson fund, has partnered with Fulbright-Australia to bring a distinguished professor to teach in SPPAIS. Fulbright-Australia advertises, vets, and takes care of the administration for the Fulbright scholar as well as pays for airfare, insurance, etc. SPPAIS pays a stipend of $30,000 a semester from our Foundation fund and offers the title of Visiting Simpson Fulbright Professor. This partnership improves UW's world profile, encourages internationalization, and help SPPAIS meet our teaching needs.

Asynchronous classes: POLS offers the lion's share of V requirement courses (70%), making POLS 1000 American and Wyoming Government an indispensable part of the USP. Moreover, most of our elective classes exceed 90% of the enrollment cap. Meeting demand has been a challenge. Until this year, we relied heavily on part-time instructors for these classes—both online and on-campus. However, the quality of instruction varied and most part-time instructors discontinued involvement as the demands of post-graduate study and/or careers mount, yielding substantial turnover. Jason McConnell has worked with Wiley over the past semester to create a state-of-the-art asynchronous POLS 1000 class. Using this template, GA's answer questions about the course and content under the supervision of a full-time faculty member. This change has standardized the content taught and reduced the number of part-time instructors needed. SPPAIS has used the added income to hire more GA's to teach these classes, ensuring enough teaching support for all the courses.

American Heritage Center (Paul Flesher): Reference Services has a number of activities that bring in money. For instance, we have a massive of archive of geological research data from Anaconda. For CY2021, we are on track to bring in over $30,000 in membership and digitization fees from firms that want access to that data.

Anthropology (Todd Surovell): The Frison Institute does a lot of fundraising. Jason Toohey (jtoohey2@uwyo.edu) is its current director. According to the department head, that's where most of the nontraditional revenue is generated.

Communication and Journalism (Cindy Price Schultz): Foundation funds have been used to hire two graduate assistants. One is the PR and Marketing person who is focused on creating the newsletter to alumni and donors, and organizes events, such as donor-supported Larsh Bristol Photojournalism Fellowship and Muhlberg Study Abroad award. The other funds a debate coach who helps the program attract top-notch students that give UW national and international recognition in a scholastic forum. Ties to the Honors College, as well. Recently received $1.25 million for the Bobby Model Photojournalism Professorship and Fund that will pay part of the professor's salary and be tied to some entrepreneurial ideas for creative-oriented students/business owners.

Working Group 2: Entrepreneurial Asset Inventory

The charge of the Entrepreneurial Assets Subcommittee wasto make a list of courses, organizations, programs, initiatives, researchers, and staff members who are involved with entrepreneurship in some way. This includes tenure-track, non-tenure-track/lecturers, graduate students, and staff. Many of the activities and people on this list have been around entrepreneurship for several years, but some are insular and may not be aware of each other. The multi-disciplinary information collected here will contribute to the development of a University of Wyoming ecosystem that will assist economic development and other aspects within our state.[1]

The bottom line is that entrepreneurship-focused academic programs exist across campus, but they need to be united to allow the entrepreneurship ecosystem to flourish, and to further support statewide economic diversification. For this to be most effective, a central location (or "front door") should be established to provide experiential learning opportunities for Wyoming students, strengthen partnerships with Wyoming businesses and community colleges, and promote research and entrepreneurial endeavors.

At this point, this is likely not an exhaustive list, but it is a good start for the first draft. The list is divided into entrepreneurial activities/research and teaching/educating others to be entrepreneurial or support entrepreneurship. It is only a list of what is currently happening, not what these areas propose to do in the future. For classification purposes, it is broken into Colleges.

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[1] Information about innovative ways to make money for the units or the University were sent to other subcommittees in this pillar.

College of Agriculture & Natural Resources

College-wide: Teaching/Education: The overall curricula is focused on training and educating agriculturalists, veterinarians, scientists, and students as entrepreneurs in ag production and service industries

Agriculture and Applied Economics: Entrepreneurs/Activities: Faculty members have research in entrepreneurial areas, such as negotiation analysis, agricultural risk management, and supply chain coordination. Teaching/Education: Stackable certificates in areas of need in the state and regions, such as ranch management, food policy, agricultural entrepreneurship, risk management, or personal finance. Class in Agribusiness Entrepreneurship.

Agricultural Communications: Teaching/Education: Overall program promotes entrepreneurship since many students build their own businesses, return to established family businesses, or support the marketing efforts of agriculture businesses

Family & Consumer Sciences: Entrepreneurs/Activities: Spin off textile company. Teaching/Education: Several classes training students to be entrepreneurial.

Extension: Leader in community-based education and statewide engagement with the land-grant university as the foundation. Active engagement with Wyoming people, institutions, and communities demonstrates UWE's commitment to our organizational values, including innovation, entrepreneurship, and respect. Community-based support creates opportunities for resource development.

Molecular Biology Department: Entrepreneurs/Activities: Thomas Boothby, filed intellectual property claims about novel bioprotectants; Grant Bowman, CEO of AsimicA (biotech startup); Mark Gomelsky, patent holder and interested in developing his light-biosensors for medical use; Don Jarvis, CEO of Glycobac LLC (biotech startup); Dan Wall, exploratory efforts to identify novel antibiotics; Jongchan Woo, exploring chemical modifiers of autophagy as novel cancer treatments.

Plant Science: Entrepreneurs/Activities: Vertical hydroponic system used by Plenty was developed by former Ph.D. student Dr. Nate Storey (Plenty Co-founder and Chief Science Officer). Royalties from that invention support entrepreneurial research.

College of Arts & Sciences

Communication & Journalism: Entrepreneurs/Activities: Cindy Price Schultz researches digital media entrepreneurship and management; Teaching/Education: Minor in Marketing Communication combines marketing and communication classes. Business and Professional Communication is part of the Entrepreneurial curriculum; numerous classes in the department have Wyoming businesses for clients, such as Advertising, Multimedia Production, Public Relations, Graphic Design, Rhetoric & Social Justice, Web Design, and Photography.

Geology & Geophysics: Entrepreneurs/Activities: John Kaszuba, Joint Industry Project with ConocoPhillips. He is also the John and Jane Wold Centennial Chair and works with the Wold Companies and Wold Foundation.

Math & Statistics: Entrepreneurs/Activities: Ken Gerow, National Park Service grant; Craig Douglas, Stephan Heinz, Rongsong Liu, Zhuang Niu, and Ping Zhong, NSF grants of different types regarding modeling and data; Hakima Bessaih, Jason Williford, and Ping Zhong, Simons Foundation grants; Ken Gerow & Annalisa Piccorelli, NIH grants; Tim Robinson & Shaun Wulff, grant with the Wyoming Department of Health to provide data science expertise. Robinson also has a US Fish & Wildlife grant and Wulff, one with Wyoming Department of Transportation. Teaching/Education: Eric Quade, NASA Space Education Enhancement Grant; Jason Williford taught an online course for practicing high school and college teachers in game theory last summer.

Music: Entrepreneurs/Activities: Musicians can book gigs with the "Hire A UW Musician" link. Teaching/Education: Nicole Riner oversees the Music Entrepreneurship Certificate. She also teaches the courses in entrepreneurship.

Philosophy & Religious Studies: Entrepreneurs/Activities: Rob Colter organizes Stoic Camp for Corporate retreat; Brad Rettler studies cryptocurrency

Psychology: Entrepreneurs/Activities: Robin Barry and the Dementia Support Center. Applications of current work include a home and community-based services organization. Training programs being developed could be marketed to providers. Josh Clapp and Sean McCrea have collaborations with faculty in College of Engineering, grant-funded research intended to optimize human-machine interactions and develop mobile applications for voice training in transgender community, grant-funded research on use of videogames to motivate motor and cognitive rehabilitation, consulted on development of posture-control apparatus; Chris McKibbin and Wyoming Center on Aging: Worked with a tech development company to assist with the development of an online intervention. WyCOA also has worked on a CNA Apprenticeship Program that supports training and employment for CNAs. Teaching/Education: Matt Gray, Professional Issues and Ethics (PSYC 5530), focuses on setting up a private practice and developing an independent clinical career (including telehealth outreach to rural communities); Clinical Ph.D. program: APA accredited program, graduates eligible for professional licensure in most US states and territories; students get training in their practicum teams on advertising and recruiting, collecting fees, managing patient flow, and using empirically supported, short term therapies to maximize efficient use of therapist's time; Clinical faculty have also offered workshops/professional development for providers in the community/state.

Theatre & Dance: Teaching/Education: Curricula provide entrepreneurial skills; collaborative nature of performances, internships and senior projects builds a comprehensive skill set for students to be successful in a company, or in the company they found.

Visual & Literary Arts: Entrepreneurs/Activities: Ashley Carlisle, Winddriven Studios with David Jones of Visual Arts. Large-scale public art projects and artworks for homes and businesses. Teaching/Education: Neltje Center for the Visual and Literary Arts, a place to honor and showcase the contemporary visual and literary arts and an educational facility for residencies, workshops, symposia, conferences, art exhibitions and literary readings.

Center for Design Thinking (Brandon Gellis, co-director with Amy Banic, Computer Science). Conducted in-person and online workshops exploring various approaches to Design Thinking and entrepreneurship. Working on a consumer-based project for projection with a client. Held a number of design, innovation, and entrepreneurship-oriented classes. FYS Innovation and Entrepreneurship course. Ashley Carlisle's Sculptural Practices and Professional Practices courses teach students idea generation, creative problem solving, invoicing, presentation, and bidding out a creative project, whether it is a public art piece, architectural accoutrement, or industrial design object.

College of Business

College level: Entrepreneurs/Activities: Steve Farkas, assistant dean, support businesses across the state, including IMPACT 307, Small Business Development Center, and Manufacturing Works. Teaching/Education: Entrepreneurship major and minor. Major for COB students; minor for non-majors. (Patrick Kreiser, Peter Scott from CEAS). Experiential learning throughout curriculum.

Management & Marketing: Entrepreneurs/Activities: Ellbogen 50K Entrepreneurial Competition that helps student-led teams get seed money to start companies – Patrick Kreiser and Ronn Smith; Teaching/Education: Corey Billington, professor of practice. Classes incorporate a business or marketing plan for business in the state. Runs a Faculty Entrepreneurship workshop; Entrepreneur outreach programming in collaboration with Wyoming After-School Alliance offered to Wyoming Association of Career & Technical Educators that offers curricular assistance and professional development (graduate credit) for state high school teachers. Matt Fox.

College of Education

Entrepreneurs/Activities: Faculty members have grant work and sponsored programs, such as the Preschool Development Grant, Augmented Reality, WITS, SWARMS, TACoS, GenCyber, and Special Education. Leigh Hall, one of the Excellence Endowed Chairs in Literacy Education, developed an online platform called Literacy Teachers, that guides online instruction so teachers can help their students become better readers and writers.

College of Engineering and Applied Science

Dean's Office: Entrepreneurs/Activities and Teaching/Education: Peter Scott, Entrepreneur in Residence. Guest lectures on entrepreneurship in Senior Design classes and Pharma classes or other interested faculty. Part of Entrepreneurship faculty in College of Business. With Central Wyoming College, runs Entrepreneur Essentials course, a six-week statewide education program that the CoB and CEAS has for entrepreneurs across Wyoming. For the College, Entrepreneurship for Engineers elective and experiential work throughout the curriculum.

Innovation Wyrkshop. The largest makerspace in Wyoming, and one of the largest and best-equipped in the Mountain West. Run by Tyler Kerr. Free and accessible to everyone. Training programs equip entrepreneurs with the tools necessary to make their ideas/prototypes a reality. Grant funding to set up a targeted entrepreneurial program (the Pioneer Program) to serve as a network between entrepreneurs and trained makerspace users. (See Appendix B).

Atmospheric Science: Entrepreneurs/Activities: The department in essence runs a small not-for-profit business, although it is not registered as such for tax purposes. It has sufficient external funding to employ 15 people without any UW/state support. Building initially on research grants for atmospheric instrumentation, it has had several business offshoots over the years.

Chemical Engineering: Entrepreneurs/Activities: David Bell, research funded by the Carbon Engineering Initiative, a state-funded SER program that seeks to convert Wyoming coal to non-fuel products.; John Oakey, tools and techniques related to Biomedical Engineering that span development readiness levels and appropriateness for commercialization. Has launched a startup company to commercialize several innovations; Patrick Johnson. Teaching/Education: David Bell, Process Design I and II, the capstone chemical engineering classes. Many projects involve potential business ventures in Wyoming.

Civil & Architectural Engineering: Entrepreneurs/Activities: Jon Brant, Director of the Center of Excellence in Produced Water Management, which focuses on the development of nanofibrous materials for applications, such as filtration and desalination. It targets resource recovery from industrial brines like produced water or municipal waters; Michael Urynowicz, CEO at EnWyo, LLC and Chief Technical Officer at Cowboy Clean Fuels. Cowboy Clean Fuels, along with its technology partner EnWyo, LLC, was formed in 2020 to commercialize the UW-owned patent, Biomass-Enhanced Natural Gas from Coal.

Computer Science: Entrepreneurs/Activities: Ruben Gamboa, business creation of three software companies; Philip Schlump, professor of practice and entrepreneur; Lars Kotthoff & Mike Borowczak serve as technical advisors to Wyoming startups; Teaching/Education: Amy Banic, co-director, Center for Design Thinking, and co-teaches a FYS course in entrepreneurship; Senior Capstone Course has led to business creation.

Electrical and Computer Engineering: Entrepreneurs/Activities: John Pierre, with two professors at Montana Tech University, has a patent in the area of oscillation analysis in power systems using synchrophasor measurements; Suresh Muknahallipatna, in collaboration with McGinley Orthopedics, an Augmented Reality-based medical device to aid surgery was developed and sold to hospitals nationwide. In collaboration with Simplot Agriculture, in Rock Springs, is developing a drone-based measuring device to perform volumetric measurements of fertilizer piles.

Mechanical Engineering: Entrepreneurs/Activities: Erica Belmont, co-founded a start-up company with one of her Ph.D. students to commercialize technology that they developed under an NSF EAGER grant. They have won awards from the Ellbogen Entrepreneurship Competition and the WY Phase 0 program, and currently have their first SBIR proposal under review; Carl Frick, co-Founder of Impressio.Tech, which has two current SBIR Phase 1 grants from NSF & NIH and employs one former UW student. Co-inventor on one fully issued patent and numerous invention disclosures while at UW. Technical Lead for I-Corps teams; Dmitri Mavriplis, Owner of Scientific Simulations LLC, which has had four SBIR/STTR Phase 2 awards over the last 10 years, including active Phase 1 & Phase 2 SBIRs from NASA. The company employs three former students/postdocs from UW; Jonathan Naughton, Director of the Wind Energy Research Center. Founded two Wyoming start-ups as a UW faculty member and involved with three. Cumulatively supported by many federal grants, including several SBIRs and STTRs. Currently employs four former students. Teaching/Education: In the senior capstone

design course, more than eight student groups have been finalists of the Fisher Innovation Launchpad during the past five years.

Petroleum Engineering: Entrepreneurs/Activities: Mohammad Piri, Director of the Center for Innovation for Flow in Porous Media, has developed a commercial enterprise, Piri Technologies; Hertanto Adidharma, Morteza Dejam, Maohong Fan, Lamia Goual, Mohammad Piri, Soheil Saraji, and Brian Toelle have been involved in six patent developments of the last two years. These developments cover the range from patent approved, provisional patent application, and patent disclosure.

College of Health Sciences

Kinesiology & Health: Entrepreneurs/Activities: International Kinesiology Center; Derek Smith & Arthur Zhu and an undergraduate student perform research funded by a NSF undergraduate research fellowship. MoVE LLC fosters student innovation, while Zhu and Smith teach technology transfer and translating ideas to marketable products through graduate coursework and student mentorship.

School of Pharmacy: Entrepreneurs/Activities: The Wyoming Health and Bioscience Innovation Hub is housed in the School of Pharmacy. This is a public-private partnership to support bioscience innovation and entrepreneurship from initial idea, through proof of concept, pre-clinical and clinical testing, regulatory approval, and commercialization. Teaching/Education:

Nervana Elkhadragy, Pharmacy Management, Marketing and Finance (PHCY 6246) includes a module on entrepreneurship.

College of Law

Teaching/Education: George Mocsary teaches a Entrepreneurship & Business practicum that started in 2019. The course gives students a combination of classroom training on entrepreneurship and small business law, practical experience performing legal tasks for Wyoming small businesses, and networking opportunities to let them hit the ground running in Wyoming's small business ecosystem upon graduation.

University Libraries: *College Level*: Entrepreneurs/Activities: Stephen Boss, in conjunction with Cynthia Hughes, has a project related to how rural libraries can support entrepreneurs, such as developing technology spaces for entrepreneurs and small businesses; Ivan Gaetz is planning an internal working group to outline best practices for libraries to support economic development activities. He also convened a Blockchain working group to investigate possibilities for libraries support and partnership. Teaching/Education: Entrepreneur meeting space on Level 1 of Coe Library, a formal meeting area where students can hold pitch and funding meetings, and develop their ideas and present them; the collections team licenses statewide access for business and related databases and journal subscriptions to support local entrepreneurs and small businesses throughout Wyoming (in partnership with the Wyoming State Library); provide

library instruction and research/ chat support for faculty, staff, and state residents doing research on entrepreneurial projects.

American Heritage Center: <u>Teaching/Education</u>: The AHC has a number of collections from entrepreneurs in many different fields, especially in the late 19th and early 20th Centuries.

Haub School of Environment & Natural Resources: <u>Teaching/Education</u>: Tourism minor has many entrepreneurial and outreach-oriented classes to help businesses in Wyoming; entrepreneurial mindset throughout curriculum.

School of Energy Resources: Multi-disciplinary research initiatives underway in the centers of excellence. Projects are intended to spur development of Wyoming businesses and commercialization of energy technologies. Several graduates create their own businesses.

Other entities not under a college

Advising, Career, Exploratory Studies Center (ACES): <u>Teaching/Education</u>: ACES and the other career services offices on campus (including in the College of Engineering and Applied Science and College of Business) are connected to entrepreneurship through the job posting, the internship platform Handshake, Job Fairs, employer engagement staff that work directly with companies and organizations sourcing talent, and a Live Local Work Local program that takes UW students to Wyoming communities to explore what it would like to live and work in that area. The SOAR program and Suitable software provide student engagement in career readiness activities that build and document their experiential learning, internship and research experiences.

Wyoming Institute of Disabilities: <u>Entrepreneurs/Activities</u>: Eric Moody, research includes a physician from Cody using machine learning to support aging in place (vs moving elderly patients to nursing homes), and a company in Boulder, CO. working on a device to support children with Autism Spectrum Disorder. Collaborator with Arthur Zhu from K&H on his Small Business Technology Transfer grant on a device to support tele-rehabilitation.

Associated entities

IMPACT 307 is a network of innovation-driven business incubators that advise and support high-growth startups in the early stages of business development. IMPACT 307 works to diversify Wyoming's business landscape, fostering creative, solution-based ideas that add value to the state and local economy. David Bohling is director and Fred Schmechel is assistant director.

Wyoming Technology Transfer and Research Products Center supports entrepreneurial efforts by working with UW faculty, staff, and students to develop a robust protection and commercialization plan ranging from patent applications to copyright registrations. It also supports entrepreneurial efforts through licensing UW technology to UW spinouts and third

party companies, and providing education about intellectual property as needed for undergraduate students, graduate/professional students, and UW faculty. Directed by Victoria Bryant.

Small Business Development Center, Business Resource Network, and Manufacturing Works. The subcommittee did not receive information from these entities, so a summary should be added about their contributions.

Where does the Wyoming Innovation Network fit?

Appendix A: <u>University of Wyoming SPIN-OUT Companies</u>

Company	Year Founded	UWYO Faculty/Student
CellDrop Biosciences, Inc.**	2020	Oakey, John Noren, Benjamin Scott, Peter
Literacy Teachers*	2019	Hall, Leigh Ann
MoVE, LLC	2018	Zhu, Qin
Piri Technologies*	2017	Piri, Mohammad
MKS Technology	2017	Carron, Keith
TLS Materials LLC	2016	Dongmei (Katie)Li
Lev'sonic, LLC	2016	Levente Pap Keith Carron
FieldBlogger, LLC	2016	Bryce Tugwell
Teton Composites	2016	Andrew Hansen
SHArK Science Outreach LLC	2016	Bruce Parkinson
Aseman LLC	2016	Seyed Hamid Sanei
Medicine Bow Pharmaceticals LLC	2015	Baskaran Thyagarajan
Catering Calculator	2015	Kenneth McConnel
Bridge Sense, LLC	2014	Mike Jung
NutriWyo, LLC	2014	Sreejayan Nair
Pollution Control Technologies, LLC**	2013	Robert Corcoran Kaspars Krutramelis Rodolfo Monterroso
ESal, LLC	2013	Teresa Nealon
Arnoldware Applications, LLC	2013	Mark Arnold
PlankTOMICS Algae Bioservices*	2013	Stephen Herbert Levi Lowder
Alpenglow Instruments LLC	2013	Nicholas Mahon
Project Guide Services LLC	2013	Chet Lockard Robbie Lockard
GlycoBac, LLC*	2011	Don Jarvis Christoph Geisler

Bright Agrotech*	2010	Nathaniel Storey
Snowy Range Instruments	2010	Keith Carron
ENWYO LLC*	2010	Michael Urynowicz
EnvisionFinancials, LLC	2010	Jeremy Page
WyoComposites, LLC*	2009	Dave Walrath Heath VanEaton
TigerTree Land Management	2007	Jeffery Smith Emily Parsons
Happy Jack Software	2004	Mona Gamboa Jeffery Van Baalan
Train for Power Systems LLC	2004	JeNey Jackson
Firehole Technologies*	2001	Andrew Hansen Chris Key Randal Six Steve Mays Mark Garnish Jared Stack
Supercritical Fluids LLC*	2001	Maciej Radosz
DeltaNu*	2000	Keith Carron Robert Corcoran
Blue Sky Group Inc.*	1998	John Pope Daniel Buttry
SoftRay Incorporated*	1997	Paul Johnson
WEST, INC	1990	Dale Strickland Lyman McDonald
Bridgetech, Inc.	1988	Jay Puckett
IDES Prospector	1986	Mike Kmetz

*Companies that have a direct license with UWYO (patent/software)

**License agreement is in negotiations and is expected to be executed soon

Appendix B

List of Makerspaces in Wyoming

There are ten major makerspaces in Wyoming. Tyler Kerr runs the largest one at UW, and his team oversees five additional makerspaces around the state (Casper, Cheyenne, Pinedale, and Evanston). Powell, Riverton, Sheridan, and Gillette make up the remainder. Western Wyoming Community College is considering in setting up a space there.

The team has designed a robust, standardized, institutionally agnostic experiential learning ecosystem (the "Maker Access Pass") that the majority of other makerspaces in Wyoming have asked to be able to use. By end of year it will be live in nine of Wyoming spaces, and at least one out-of-state makerspace.

Powell Makerspace (Northwest College) has asked to join the large library of free programming. The free, standardized workshop programming is the uniting factor for all of the makerspaces statewide. Similar to Powell, Riverton (Maker Space 307) and Sheridan (Phorge Makerspace) have inquired about joining the programming.

With these three outside makerspaces (Powell, Sheridan, Riverton) included, the shared programming uniting the network would effectively be live in nine out of ten major makerspaces.

Working Group 3: Research, Teaching, Service & Engagement

Entrepreneurship is Going for the Gold.
Entrepreneurship is Going for the Brown and Gold.
Entrepreneurship is Going for Wyoming.

Of the Four Pillars identified by President Ed Seidel—Entrepreneurial, Digital, Inclusive, and Interdisciplinary—our Entrepreneurial Enterprises are best poised to solve UW's and Wyoming's immediate and projected financial problems quickly and to lead us forward as we develop and strengthen the other three Pillars.

Entrepreneurship recognizes the need to create new ways of approaching problems and making money for our University and for Wyoming and to come up with new ways of doing it immediately.

Entrepreneurship is Going for the Gold. Yes, we are going for the money first because we are facing an imminent budget reduction. It is necessary and practical to identify new sources of income and to implement them quickly. Finding Entrepreneurial solutions for UW and for Wyoming will help us all succeed. We are also Going for the Gold Standard to produce high quality Innovative and Entrepreneurial products and outcomes with enduring benefits for our students and communities. *Entrepreneurship is Going for the Gold, it is Going for the Brown and Gold, and Going for Wyoming.*

ENTREPRENEURIAL LEADERSHIP STRUCTURE

To fulfill President Seidel's charge to create a structure and timeline to implement the Entrepreneurial Pillar, we propose the following five-year, phased in administrative structure:

Phase 1—Year 1. Start NOW in April 2021 in time for summer registration. Start from existing strengths and start with the practical:

- **Entrepreneurship and Innovation Council**, led by Interim Directors Steve Farkas, Danny Dale, and Cindy Price Schultz, assembles 10-person Entrepreneurship and Innovation Council of Entrepreneurial leaders from UW and Wyoming Entrepreneurial Sectors. Suggested members of this leadership team include representatives from: Distance/Outreach Education; Office of Outreach and Engagement; Office of Diversity, Equity and Inclusion; Impact 307; CEER; Wyoming Community Colleges; Wyoming Business Leaders; Agriculture Extension Office; SLCE Service Learning and Community Engagement; Communications and Institutional Marketing; Wyo Arts Council; Wyoming Institute for Humanities; Wyoming Excellence in Higher Education Endowment; Centers of International Business Education and Research (CIBER); Research and Economic Development Office; UW Foundation, etc.
- **Launch additional Outreach/Distance Curriculum for delivery beginning Summer 2021 with strategic "one rate" tuition.** Fully Online Asynchronous courses are fast money-makers that fulfill needs for currently available coursework leading to degree completion. We propose and

advocate for the immediate implementation of "One Rate" Tuition for Distance Education coursework. Distance has no Boundaries, neither should tuition. Instead of a Resident/Non-Resident tuition for all of our Distance/Outreach classes, charge one accessible rate for all these classes that encourages out-of-state and worldwide students to take our courses. This strategic tuition action will generate income immediately because it targets a new audience outside Wyoming while serving Wyoming students statewide in High Schools, Community Colleges, and nontraditional and retraining settings.

- **Fast Track current Entrepreneurial activities.** Identify income producing activities that need additional impetus of funding and resources now, and connect with AVP for Finance and UW Foundation to direct funding to them. Examples can include anything from funds to develop new Online coursework, to purchasing production equipment, to launching faculty start-ups. Support can be for existing entrepreneurial economies (Agriculture, Education, Energy, Extraction, Tourism) and newly emerging economies.
- **Advertise, Advertise, Advertise.** Develop robust online web presence to organize and promote Entrepreneurial activities. Now, in time for summer registration, advertise Outreach Classes, Entrepreneurial Classes, Online degree programs, Grant competitions. Ramp up what we already do, hire additional Marketing personnel.

Phase 2—Years 2 + 3. Organize and Refine Entrepreneurial Mission

- **Identify and Advertise funding and opportunities** for Entrepreneurial Research, Grants, Teaching, Service, Engagement, and Internships. Make current opportunities easier to engage (maker spaces, incubators, etc).
- **Create an Enduring Administrative Structure (Center/Council/Consortium, AVP, Research Park?)** that serves as an efficient and easily recognizable portal of access to coordinate and streamline entrepreneurial and innovation efforts in order to achieve consistency, impact and follow-through.
- **Hire administrative personnel and Cluster Hires of** Entrepreneurship/ Innovation faculty and interdisciplinary faculty, such as the joint College of Business and Engineering IEE.
- **Seek funding for Entrepreneurism and Innovation Administrative Structure and Programs.** Involve Corporate and Individual Donors through Foundation.
- **Curriculum Integration and Delivery.** Move Forward and Incentivize Entrepreneurial Curriculum, Programs and Internships. Create Entrepreneurial Suffix to identify Coursework.
- **Survey, Identify and Involve Additional Stakeholders.**
- **Policy formation for T+P recognition.** Department heads will need the flexibility to write Job Descriptions to reflect Entrepreneurship and Innovation contributions. Build this work into UW performance reviews and T&P
- **Establish Entrepreneurship Recognized Student Organization (RSO)** Establish an entrepreneurship-themed student organization
- **Diversify Revenue Base and Raise new revenue streams** from grants, licenses, gifts, corporate partnerships.

Phase 3—Year 4 + 5. Center/Consortium fully operational, up and running.

- **Administrative Structure in place**
- **Building Projects**
- **New Business Incubators and Entrepreneurial Launches**
- **New Endowments**
- **Financial disbursement and sustainability**

WHERE ARE WE GOING? Entrepreneurism Looks Forward—Here are upcoming entrepreneurial curriculum and projects that are ready to launch or in the planning stages and need the impetus of the Entrepreneurial and Innovation Council to stand up the Entrepreneurial Pillar now to help us Go for the Gold.

EDUCATION IS ENTREPRENEURIAL IN THREE WAYS:

A) Teaching Entrepreneurship

B) Entrepreneurial Teaching and Partnerships

(A) Teaching Entrepreneurship

Education and a Culture of Education are essential to all Entrepreneurial Ecosystems. Education is a key Economic Sector in Wyoming--at all levels: K-12, Community Colleges, Trade Schools, and UW. What better place to begin leveraging our existing programs and trained faculty than to support the following Curriculum proposals for forward-thinking solutions that emphasize the importance of Entrepreneurism and the interconnectedness of the Four Pillars:

1. **Infuse the Four Pillars (Entrepreneurial, Digital, Inclusive, and Interdisciplinary) into the student experience at all levels:**
    - Create a **suffix for course numbers** that identifies Pillars Classes: Entrepreneurial, Digital, Inclusive, and Interdisciplinary. This will also help us track Student Credit Hour production and resource allocation for Pillars classes. For Example: Business Chinese would be numbered CHIN 3055P to indicate that it is a Pillars class, offering one or more of the Pillars (in this case it incorporates Entrepreneurial, Digital, Inclusive, and Interdisciplinary Coursework).
    - Offer **First Year Seminars** in each of the Pillars.
    - *Require classes* in at least 2 Pillars for all undergraduate majors.
    - Offer **Pillars Internships** in all semesters, including summer and J-term.
    - Offer **undergraduate Living/Learning communities** centered on the Four Pillars in specially designated dormitories.
    - Develop **individual courses, minors, and majors** that directly address the four Pillars.
    - Offer **senior capstone projects and Internships** in each of the Four Pillars.
    - Offer **graduate level coursework** and modern approaches to Entrepreneurship and connect them to the other Four Pillars.
    - Outside of class, offer **Extracurricular and RSO activities** for the Four Pillars.

- Develop **fully Online courses, minors, and majors** that directly address the Four Pillars and allow access for Wyoming High School, Community College, and nontraditional students.

2. **Development of Entrepreneurship Curriculum for courses and degrees:**
   - Create an **Interdisciplinary Entrepreneurship Curricular Grant Program**. Leverage College of Business's Entrepreneurship Minor (3 core course within COB; 2 electives within each student's major area), and promote the development of entrepreneurship electives throughout the campus. Have faculty submit grant applications; award $5,000 (individual; $10,000 1+ faculty) grants to faculty to develop one or two courses that will serve as the two electives to fulfill the COB Minor. To prevent a "hodgepodge" of courses sporadically developed throughout the campus, the Grant Program would be coordinated through the Entrepreneurship and Innovation Council.
   - Create **Entrepreneurial Arts curriculum, BFA in Visual Communication Design** (to replace the BA in Studio Art with a Concentration in Graphic Design). The Art and Art History Program in the Department of Visual and Literary Arts seeks to offer a new professional level degree (BFA in Visual Communication Design). It will require no new faculty, no additional funding, and would increase student digital literacy and knowledge of professional-design industry practices while providing a professional degree path in Design.
   - Create **Entrepreneurial Humanities Degree, BA in Public Humanities** (a concurrent degree with connections to many other existing degrees). A public humanities concurrent major and minor will allow programs to come together to build a new interdisciplinary, applied program that prepares undergraduates to enter the cultural, non-profit and public service workforce in Wyoming. Public humanities majors will leave UW with an excellent disciplinary foundation, a practical set of skills, statewide contacts and partnerships, and the tools to make a difference in the cultural economy. The public humanities curriculum augments a traditional humanities degree. Creative thinkers with functional skills will be poised to make an economic impact in Wyoming and beyond.
   - Create additional **Entrepreneurial Production-oriented Classes in Communication and Journalism:** training for minority entrepreneurs and digital media entrepreneurs so they can lead successful economic development in their communities. COJO's numerous production-oriented classes help businesses promote themselves through advertising, public relations, graphic design, writing, video production.
   - Create **Certificates in Entrepreneurship-related areas and creative fields and certificates in Science communication/ interdisciplinary groups.**
   - Create **Entrepreneurial Internships** in Wyoming to encourage Wyoming students to stay in the state and Wind River Indian Reservation communities once they graduate.
   - **Equip Wyoming graduates to go anywhere** they need and want to go nationally and internationally (including staying in, moving beyond, or returning eventually to the state).
   - **Entrepreneurial Experiential Learning and Entrepreneurial Faculty Engagement**. Join the Centers of International Business Education and Research (CIBER) and add a business-language aspect to undergraduate teaching and research. Through CIBER,

students can do internships in companies in other parts of the world. Students can participate in the International Symposium on Language for Specific Purposes organized by the University of North Carolina, Charlotte and expand their ideas and entrepreneurial horizons using the world languages they are learning.

- Create **paid internships or emulations of work environments that focus on language and technology** in order to apply lessons learned in class. Projects typically revolve around practical problem solving that would normally occur within language technology companies that need one-time solutions for a specific language and technology problems.
- Create **practical entrepreneurial interdisciplinary coursework and internships** for business, military, medical, and legal applications that require multiple languages. For example, services for standardization of forms in health services (intake forms in different languages: creating and processing information), email content sorting, Business Chinese, Spanish, Japanese, German for Business, Law, Medical personnel.
- Work with **NGOs and Non-Profit Groups** with projects for bilingual clients to acquire entrepreneurial skills in their own language.

(B) Entrepreneurial Teaching and Partnerships

1. Increase Distance Education offerings and enrollments. Online courses are a financial necessity and a viable Outreach for three reasons--(1) They increase revenues for the department, college and UW. (2) They respond to statewide demand from High Schools and Community Colleges for UW curriculum available online. (3) They reach a new target audience outside UW and beyond our borders.

- Move our **Criminal Justice Online** degree from a degree completion program to a full degree program. Currently students have to go to a Community College first, then complete their degree through our distance program. This limits our capacity to attract out of state students and in-state students who don't have immediate access to a Community College. We are planning for our degree program to begin in Fall 2022.
- **Online Minors, Majors and basic courses in all languages**. Modern and Classical Languages Dept, with funding from CARES, partnered with Wiley instructional designers in Fall 2020 to design 32 new fully Asynchronous Online courses in Classics, Chinese, French, German, Japanese, and Spanish. Will launch online minors in Summer 2021.

2. Engage Wyoming schools at all levels.

- Make additional money quickly and lead our state's Entrepreneurial Educational Enterprise forward by launching new teaching modes and curricular offerings. Lead the way by supporting K-12 education, including K-12 STEM education, and Wyoming's Community Colleges and increasing the number of Distance Ed offerings at UW and Community Colleges. As early as this SUMMER 2021, begin offering more Online courses, which are a perfect blend of Digital learning and Entrepreneurship.

- School Partnerships. Dual Language Instruction in K-12 schools is the new wave of immersive, interdisciplinary teaching where students learn all school materials in two languages simultaneously—usually Spanish and English or Chinese and English. Several High Schools around the state now offer dual language coursework where their students take High School classes that earn them UW credit. School principals in Gillette are working with UW departments to form reciprocal partnerships to add UW Spanish classes to their curriculum. By sharing resources and increasing the number of dual credit offerings in High Schools, their students earn UW credit and arrive at UW ready to place in upper level coursework and begin work on minors and majors.
- Work with Community Colleges to create dual enrollment classes that students can take at either the Community College or UW level. Reverse credit allows UW students to complete AA degrees begun in Community Colleges.

3. Create Practical curriculum for new targeted audiences with applications to community needs

- **Tourism**. When travel bans are lifted, the travel market will improve, and Study Abroad programs will take off. Not only will our students want to travel abroad, but many foreigners will again flock to Wyoming for Tourism. Online Courses in Wyoming Geography, Ecology, Recreation, Language (Tourist Chinese, English as a Second Language) will entice travelers. When Wyoming travel is advertised, let's promote a list of online courses for tourists coming here.
- **Summer training institute for law enforcement** agencies
- **Community Economic Development Coordination** of a series of integrated Entrepreneurial activities…the recipe for successful, focused and sustainable relationships with our communities.
- **Warren Air Force Base students** are reimbursed for taking classes—anything from languages to criminal justice to political science. There are untapped markets that we can develop now.
- **Internships in Latin American businesses** that combine business and language skills

- **Language for Business** has a wide range of specialties, including Business Culture, Marketing, Human Resources, among others.
- **Spanish for Healthcare Professionals** for language and cultural understanding of the diverse communities within Wyoming, nationwide, and outside of the U.S

4. New Ideas for Curriculum Development will generate new revenues. Here are some examples:

- Professional Master's program in Geology.
- Development of a School of Earth Science with Atmospheric Science
- Degree program in Sociology will begin in Fall 2021

5. Summer Entrepreneurship Internships—UW does not get full use of our beautiful campus facilities in the summer. Create internships, summer institutes, entrepreneurial workshops during summer.

6. **Entrepreneurial Faculty-Led Study abroad** with interdisciplinary teams. Eg. Engineers without borders Community Engagement:, Architecture/Language interdisciplinary study abroad to Europe; Astronomy/Language interdisciplinary study abroad to Chile.

7. **Entrepreneurial Product Testing**—high altitude training, testing severe conditions

8. **Intergenerational internships** with Emeritus mentors and guest teachers, particularly in summer.

9. Entrepreneurial Ideas for long-term exploration and development: **Arts Incubators** Example: https://arts.uchicago.edu/artsandpubliclife/ai; **Neltje Center for the Arts** http://www.uwyo.edu/uw/news/2010/09/uw-announces-landmark-gift-that-transforms-universitys-role-in-the-arts.html

Working Group 4: State Economic Objectives and Entrepreneurship

I. Introduction

Wyoming and other parts of the West are in a state of transition and flux from energy development and other traditional uses of our resource base. In the past half-century, we have relied on national markets to build and maintain our communities, roads and educational system. The quality of life we achieved was good when those markets were good and not so good when those markets were not. In this transition period we have both new opportunities and legacies of those past uses to consider.

While much of our quality of life is maintained by the natural and social capital that Wyoming is endowed with, our public finance system is funded by the energy economy. The state cannot do much about the loss of our traditional national markets, but we can start working on building livable resilient communities less dependent on such markets. The production of commodities and services for consumers outside of Wyoming are not the end goal, they have seen merely the means to an end, this being the creation and maintenance of vibrant and livable communities. To achieve this end, especially with the likely permanent transition taking place the energy sector that Wyoming has depended on for the past century, we will need to focus on new opportunities, new markets and consumers. By broadening our economy and our public finance systems we can build a new, more resilient economy with livable and engaged communities creating fulfilling and well-paying jobs and the ability to provide opportunities for current and future generations.

The new economy arising in Wyoming may still be dependent on our natural resource base, but in a different way from how it has been historically. This new economy may be less extractive and more dependent upon maintenance of environmental services from the natural assets, or it may be extractive in new ways (for example extraction of new minerals or dependence on land-intensive renewable generation technologies). Likewise, the social and entrepreneurial capital may begin to adapt to these new opportunities to access natural and financial capital within a social/entrepreneurial ecosystem that differs from what has been in Wyoming historically. We are moving into an economy that could build jobs and communities in the new economy that is part high technology, part natural assets and part traditional industries serving new and non-traditional markets. Sectors of significant opportunity include

- Health and technology-based industries
- Arts and culture
- Tourism
- Intrapreneurial changes in the traditional sectors.

Traditional and new industries rely on both the entrepreneur and what the literature calls the 'intrapreneur'. Both rely on the same cognitive and social processes. A social ecosystem may be contained in one industry, but it can leak into other industries (McCulloch, 2020). The author

frames the similarities and differences in Figure 1. The University of Wyoming can and will play a major role in supporting both entrepreneurial and intrapreneurial efforts.

Economists write about the economic base of a region or community and social scientists write about the cultural base of a community or region. According to an economic base perspective place-making comes from selling goods or services to someone outside one's region or community (Shaffer et al, 2004). Income flows into a community and the larger the economy grows, the more potential resources are available for 'non-basic' or place making in a community or region. The cultural base narrative looks at the foundations of a community differently. Gudeman (2001) argues that the base is the totality of the 'shared interests' in a region which include the resource base, and those shared interests define the sociological notion of Place. In this way of looking at a region, activities that build community and place facilitate smoother markets between residents and market relationships, and allow for selling to consumers outside of the region (Auerswald, 2017). Both are compelling concepts and are viewed as correct within their respective disciplines. While the economic view has dominated policy narratives historically in Wyoming, we now appear to be moving towards a focus on the latter viewpoint, on developing a more sustainable economic and community base, where shared interests will drive a greater share of economic activity relative to the export economy the state has traditionally focused on.
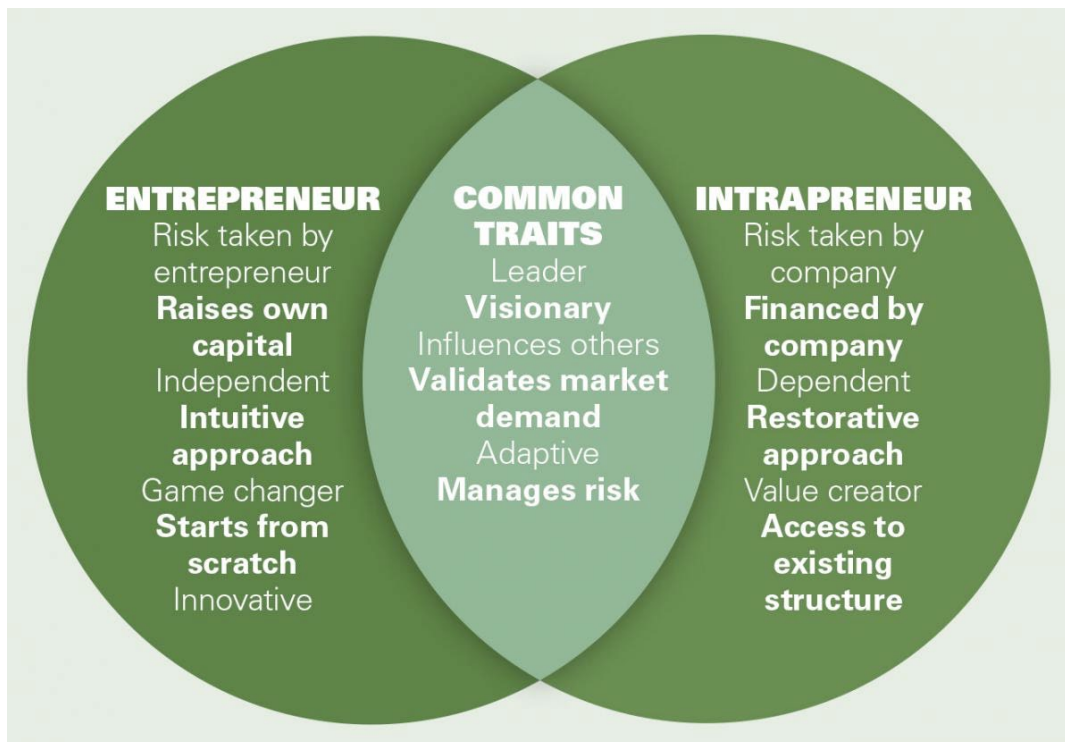

Figure 1. Identifying intrapreneurs: Who is the next disrupter? Source: McCulloch, (2020)

New industries and activities will shape the future economy of the Wyoming. They may be a combination of the place-making efforts with an emphasis in arts and culture, health education, natural asset-based tourism, health and education. Existing and traditional industries may also be part of the new economy, reacting to changes in traditional markets by building new markets and new ways to address old problems.

How Can the University of Wyoming support the State's Economic Objectives?

The University of Wyoming's role in supporting the state's economic objectives is both multifaceted and multidimensional. It will also need to be collaborative, working with community colleges and communities, existing and new industries, with policymakers at all levels of government, and with individual entre- and intrapreneurs. Efforts to support the state may be divided into two broad categories. The first category involves those efforts that are internal to the institution, focusing on programmatic efforts to develop human capital and community building assets. It also involves efforts to encourage and expand and incentivize efforts by faculty, staff and students to engage the state to help support economic development. The second category may be defined by efforts external to the institution - efforts that support and engage with entre- and intrapreneurship and state economic development efforts. These can be divided into two areas of focus: (i) direct efforts to support innovation within the state, to engage and support individual entre- and intrapreneurs by providing skills development and other means of support, and (ii) indirect support of economic development through community building and enrichment efforts, the development of cultural and social assets that will help attract new activities and people to the state. There is no part of campus that cannot be involved in both internal and external efforts. Traditional efforts in business and engineering will continue to provide programmatic support for economic development through the development of entrepreneurial education, as well as providing basic business skills, but they could also expand their engagement both directly with external constituents such as community colleges and individual entre- and intrapreneurs to develop new economic opportunities within the state. Science and technology disciplines can continue and expand efforts to develop innovations that can provide opportunities within the state through applied research that creates new intellectual property or technology development. Social sciences can engage the state in policy development both at the macro and micro level, helping communities and the state develop strategies to expand economic, social and cultural opportunities to make both community and statewide economies more resilient to inevitable changes the future will bring. Finally, the arts may provide one of the most important means of supporting economic development in the state by helping to create more livable communities that celebrate inclusivity and cultural heritage, and by creating greater opportunity to provide personal and public enrichment that engages and attracts people to Wyoming. Every area of the campus can be involved in creating opportunity for new economic activity, for developing more livable communities and for attracting new investment and maybe most importantly, by providing more opportunities and greater reasons for our youth to stay and invest themselves in Wyoming.

II. AREAS of Focus

Direct Support of Entrepreneurship at UW:

Entrepreneur development

Entrepreneur development is directly dependent on providing tools and processes to individuals to define opportunity. A current standard being used nationally is "Lean Launchpad" or "Lean Startup", defined academically out of Stanford University in the mid-2000's, but used by successful corporations for at least 40 years prior to that formal definition. It relies on a methodology of establishing a premise around a problem, and subsequent challenge/validation of that premise through customer discovery. As a solution is envisioned (or group of solutions), they too are considered premises, and validated in turn. The methodology continues systematically through market and segment definition, competition, marketing, pricing, etc., until risk is decreased, and confidence increased, both objectively.

IMPACT 307 (and UW Business Resource Network), UW, the Community College network, all have processes and curriculum in place to deliver that inculcation. But it can be dramatically improved. With the development of the ENTR major and minor, the latter being open to ALL students at UW, a good starting point has been established. The Community Colleges are actively developing similar curricula. However, academic entrepreneurship is not simply the sole responsibility of the College of Business, it needs to be embraced in all academic disciplines. The reason: Success in any endeavor can be improved through using the entrepreneurship method to help define future action, whether that endeavor is in the arts or in fundamental scientific research.

IMPACT 307 delivers Lean Startup training *experientially* through direct involvement and intervention with individuals and individual companies. The methodology is taught Socratically, and provided based on need and impact on the respective business/individual. A discreet and systematic curriculum is not followed, but the methodology is followed meticulously. Compare and contrast that to academic offering, where a deeper understanding of the theories and history of the concepts are taught, also useful and necessary, but on a different priority and timescale than an entrepreneur considering an existential decision path for their startup, where the IMPACT methodology is probably better suited to attaining outcomes.

IMPACT 307 is in the process of developing a direct engagement with all seven regional community colleges in the state. Budget has been carved out for each respective institution for the 3-year contract term. This meshes directly with the goals of the WIN program, but of equal importance provides an augmentation mechanism for Lean Launchpad mentoring/teaching and services delivery to local and regional constituents. UW will enter into subawards of the recently awarded EDA grant with each respective community college (CC). Each CC will designate a faculty member to directly engage with IMPACT and simultaneously be the direct conduit into academic enrichment with each CC. The CC will be encouraged to provide opportunity for student interns both in assisting with local logistics and marketing, but also for

potential experiential learning assisting local or regional entrepreneurs in building their business models. The direct model will be to try to emulate the IMPACT 307 relationships with Central Wyoming College (CWC) where this exact model is extant, and the growing relationship with LCCC that is moving along the same path. In both cases, CC faculty have become directly engaged with entrepreneurs moving through local/regional Startup Challenges which are operated by IMPACT 307.

IMPACT 307 will be issuing a Request for Proposals across the state, inviting communities to make a commitment towards new local/regional startup challenges. Their commitment to the process will be in building a community sponsored award fund for Finalists of each respective competition; all locally raised funds stay local. IMPACT already runs three of these in our historical region (Laramie, Casper, Sheridan), a regional competition for both Laramie and Albany counties, and two more supported by the National Science Foundation. One of these is directly targeted at the Wind River Reservation and the two sovereign tribes, and recently received a commitment from Microsoft (donation) for full award funding in a third year. CWC has played an integral role in directly counseling applicants to the Wind River Startup Challenge, along with SBDC, and overall oversight by IMPACT 307; it is a completely collaborative team effort. We expect this kind of relationship will be duplicated across the other six regions, with LCCC already engaged.

IMPACT 307 is also actively engaging with statewide stakeholders in addition to the community college network. In particular, a close relationship is being developed with the Wyoming Economic Development Association (WEDA), which provides a direct vector through their membership towards engaging directly with community stakeholders. IMPACT professional staff are also building direct relationships with community leaders, chambers of commerce, and local governments, emulating current best practices in our historical locations. Relationships are already in place with the Wyoming Business Council, the Wyoming Women's Business Center, and we intend to engage with anyone in the state, inclusively.

A recurring question that arises is, "How does a potential client find the correct pathway to advice?" Suggestions have been made to have a, "single front door," that would perform as a distributor and clearing house for all queries. Although on the surface this seems a reasonable suggestion, it collapses quickly in complexity, as exemplified by the attempt by the Wyoming Business Council to institute such a front door a few years ago.

Impracticality: At minimum this concept requires addition of personnel, overhead (e.g., marketing, independent phone systems), and cost, but with no capability to provide advice; it's a distributor. In turn, the actual person or people in this role need to be fully knowledgeable regarding requirements of what to ask and what the answers mean from an entrepreneurial, business, and technical context, which then implies that they CAN provide advice, but that in turn then becomes a redundant position to the professionals who counsel/mentor professionally with the BRN and Colleges of AG, Business, Engineering, etc.

The current system of integrated professionals who network well and have broken down historical silos, works far more efficiently and in a cost-effective manner. Any constituent query can be evaluated through questions by SBDC, IMPACT 307, Manufacturing Works, Ag Extension, and other service provider staff, with the professional fielding the query determining complexity of the question and likely necessary response(s). Answers can be provided ranging from a direct intervention on the call, to escalation to, for example, faculty science/engineering researchers at UW who may be segment experts regarding the query. Plus anything in between. That process is completely adaptable, can be escalated readily, puts the client at ease, and is efficient. It rapidly provides a correct path to the constituent. It does not need to be fixed. What can be done is development of a UW/BRN resource page that can be distributed to state stakeholders. Of note, this is the methodology that was attempted by the WBC but became untenable. A less aggressive approach might be tenable.

Indirect Support for Economic Development at UW: Arts and culture as a cultural base.

Communities that thrive have an ongoing and robust commitment to the arts and culture. People, businesses, and organizations will stay in a community, in part, because of a thriving arts culture. Focusing all attention on industry alone misses the point for developing a thriving economy. Artists are among a community's most creative individuals. Some trained artists stay in arts related fields and contribute to the culture of the community. Others may move into other fields, but they bring to those fields their learned skillsets of creativity, problem solving, teamwork, cognitive flexibility, persistence, leadership, and ethical responsibility. These artist individuals become a part of the life and energy of a community. While a vibrant arts community produces jobs and economic activity, it is the culture within a community that is created that is equally important. A strong artistic and cultural base in a community attracts new community members and keeps others from leaving.

Often overlooked as an opportunity within the arts and cultural disciplines, entrepreneurial and intrapreneurial efforts in the state often focus on arts and culture. Arts programs on campus should recognize this opportunity and ensure that education in the arts also provides examples and training necessary to allow students to pursue such efforts. The development of this cultural base within the state creates amenities that attract new people and business. Focusing on the importance of arts and culture for such benefits within arts programs could allow students both a reason for study in these areas and the ability to create a career in the arts within Wyoming upon graduation.

Internal Efforts at UW to Support State Economic Development:

Transformation of the traditional industry bases

Traditional industries in Wyoming vary in size from small operations to large internationally connected corporations. We summarize the public/ private efforts at induced technological change in both energy and agriculture

Tourism

The tourism sector has been a part of the economic base for the state for decades. As such it is an established industry but has both its entrepreneurship side as well as an intrapreneurship side. National and international demand is deeply rooted in the natural resource base here and depends on the services generated from natural assets. Here the markets are mostly by consumers in the state and nationally. Innovations are often driven from new ways to leverage services from nature as well as from conservation efforts. It also provides platform for arts and cultural development.

The University plays an important role in building the intellectual basis for entrepreneurship in the tourism industry. Such innovations can include an increased understanding of the ecological functions around species of interest, ranging from fish and game species to bird watching, predator watching, and more. Entrepreneurs can also tap into recreational and educational services for visitors to improve visitor experience and lower impacts on the environment. Enterprises such as the Draper Musuem of Natural History in Cody, the Wyoming Dinasaur Museum in Thermopolis, State Parks and Federal land management museums, and more are ideal collaborations to build more interest in tourists visiting, staying longer and learning more about our public and private natural assets. Such collaborations can also build upon and expand on what might be considered an educational tourism byway.

Programmatically, UW has a great opportunity to expand existing programs to support this sector. The Outdoor Recreation and Tourism Program (ORTM), housed in the Haub School and begun in 2018 has already attracted over 80 students to the program and produced its first graduates. It continues to grow, and classes are near capacity currently. Greater support for this program could enhance UW's ability to support this sector by not only focusing on majors, but also by providing minors to students in other related disciplines including those mentioned above. It provides an interdisciplinary opportunity to support entrepreneurial activity and to engage more deeply with the state's tourism sector than UW has done in the past. The related Hospitality Business (HOSP), a program jointly supported by the College of Business and the Haub School similarly could be expanded to support this industry. Currently, there are limited faculty dedicated to this area and it relies on the support of faculty and classes elsewhere in the College of Business and the Haub School to offer programming. Expansion of capacity in this program could provide greater support to Tourism efforts on campus. allowing UW to support these areas programmatically by reaching out to place bound students both inside and outside the state. Expansion of both programs could be achieved both on campus and through investment in remote learning.

Both the ORTM program and HOSP minor offer opportunities to cooperate with efforts at community colleges. The recent cancellation of the Hospitality program at Sheridan College offers an example of under-resourcing at the state level. Expansion of UW efforts state-wide through community colleges could buttress efforts across higher education in the state in this critical sector. Further, the Haub School has proposed expanding engagement efforts in both ORTM and HOSP through the creation of a Center for Wyoming Outdoor Recreation, Tourism &

Hospitality (WORTH) to significantly increase UW impact and achieve the overall goals of the ORTM program. The WORTH would focus on direct service to the Outdoor Recreation and Tourist industry via an extension style model with education, support, outreach, and applied research components. The goal is to brand UW as the 'go to' destination for outdoor recreation, tourism and hospitality management for existing and new businesses in the state, for example for the rancher interested in exploring options to diversify revenue, students seeking a rewarding and in-demand career, for resorts or national parks seeking to hire a talented, locally trained employees, to agencies in need of ecological or economic research. Implementing diverse platforms and programs in education, support, outreach and applied research as a highly integrated triumvirate will facilitate maximal growth of the industry far beyond what UW is currently able to deliver.

Technology:

Wyoming has targeted areas within what might be referred to as the new Technology economy as areas to be developed. These include expansion in traditional areas of communication and broadband, in data storage and high-performance computing, and in new technologies such as blockchain development*.*

Outline efforts in these areas

- Center for Blockchain and Digital Innovation as a Collaboratory on campus between computer science, engineering, business development
- High performance computing resources
    - as applied to porous media flows applicable to oil and gas exploration and development
    - Climate change modeling
    - Health, disease and pandemic modeling
    - Others
- Others

Agriculture:

Historically one of the more heavily studied industries of technological change and induced innovation is agriculture. Public / private partnerships on applied research to improve productivity, efficiency, and in more recent decade's environmental impacts are a common part of sector. Multiple studies have traced the returns to public investment in agricultural research. The most recent study by Andersen (2018) identified a historical switch in the ROI of agriculture as a result of lower public research levels relative to private. The lag times to see private sector benefits were estimated in decades level time frames. This and other work suggest that public private research collaborations can substantially impacts but ending them can have long slowdowns. The intrapreneur activities as in energy an important part of continuing development. Currently the number of technical and community develop assistance interactions in Extension and the Experiment station are substantial, ranging from numbers of participants of less then 10 to just under 2,100 in one case venue (national venue). In 2020

there were 35 long term collaborations in the State. Most of these were technical advice and training in agriculture and community development.

Technologies that bring faculty into contact with agricultural firms include, whether entrepreneurial or intrapreneurial include, drone use, GPS data and design with robotics, high technology animal feeding systems experimentation, to name a few.

III. Infrastructure

The new infrastructure for economy needs three types of capital, the maintenance of the natural assets and environmental services from those assets, flexible and communicative networks and social capital that allow communities to interact, education system to add ideas and enhance interaction, and a flow of innovation-entrepreneurs in both the new and traditional economic sectors. We identify four types of infrastructure requirements for on-campus integrated with off-campus efforts to expand entrepreneurship and economic development within the State.

1. Resilient natural assets and the associated environmental services
2. Broadband connectivity across communities and businesses as well as wider connectivity at all educational levels from K-12 to the University
3. Programming that enhances social and human capital in communities and their respective leadership across the state, and within higher education. Following Flora and Flora (2013) this includes a basic understanding in trust and reciprocity relationships, an open social network structures, group membership, cooperation, common vision and goals, leadership, depersonalization of politics, acceptance of alternative views, diverse representation.
4. Entrepreneur is more of a flow resource than a stock. Communities need a continuous flow of resilient innovation - entrepreneurial capital in all sectors, new and old.

Resilient natural assets and the associated environmental services

The natural system in the state are increasingly identified as an important asset to leverage new businesses and maintaining existing businesses. Freedman (2019 in his review of a survey of public attitudes of natural resource conservation summarized it this way: "Nine of ten Wyoming voters said conservation issues involving public lands, waters, and wildlife are as important, if not more important, than other issues related to the economy, health care, and education, when deciding whether .9to support an elected official". Tourism represented 2.9% of the State's personal income in 2019 based on surveys by Dean Runyan. So the natural resource base and natural assets are important both for quality of life by residents and job and income generation by visitors. Ongoing work identifying and mapping migration corridors will enhance the stability and resilience of some of the longest animal migration routes in the country. Reclamation of damaged areas from development and wildfires are focused on native ecological community regeneration on both public and private land which will reinforce stability

of both game and non-game species, some of which are on the Threatened and Endangered lists.

Broadband connectivity across communities and businesses as well as wider connectivity at all educational levels from K-12 to the University

A decade ago, high-reliability high-speed broadband communication was a differentiator in communities with respect to entrepreneurial health and growth. That is no longer the case; broadband communication is a defined requirement to begin the conversation. Additionally, in the New Economy, all students, regardless of their chosen educational direction will need to have a deep minimum appreciation and context in code, both in creation and in operation

Programming that enhances social and human capital in communities and their respective leadership across the state, and within higher education. To be ready for entry of new entrepreneur communities must be prepared for them. This means that the social capital in the community be well developed. Following Flora and Flora (2013) the social capital includes a basic understanding in trust and reciprocity relationships in a community, an open social network structures, group membership, cooperation, common vision and goals, leadership, depersonalization of politics, acceptance of alternative views, diverse representation. Building social capital, and especially diversity can have significant positive effects on regional as well as the national economy (Huffman et al, 2021)

(Add here a section on inclusivity efforts – women, minority and other groups inclusion can be supported at the university.)

Entrepreneurs are more of a renewable resource than a stock.

Innovation is a direct result of, "problem definition," and, "problems," can range from hyper-local to global scope.   Awareness and education around *management* of innovative thought and action can in fact be taught – it is not purely a natural skill. As such, entrepreneurship (and intrapreneurship) should be taught and experienced as early as possible in K-12, and continue through life-long exposure and challenge. Spawning new companies is only one outcome. More importantly is that Wyoming students can think entrepreneurially regardless of whether they work for themselves, or someone else, e.g., intrapreneurship

In the community entrepreneurs can come but then leave and sell the business or expand elsewhere. So communities need to come to terms with entry and exit of these resources. Many will stay if the community is open and has family or other benefits but market change and often that can mean leaving. intrapreneurship is also an important asset for communities. Business Retention and Expansion programs as defined by [Business Retention and Expansion International](#) recognizes the role that the community can play in both keeping a business or pushing a business out. Part the program is community engagement.

Arts and Culture Infrastructure

It is important the communication improves and develops among the state's existing arts and cultural organizations, K-12 education, and higher education as it relates to arts and culture. These entities have a wealth of information and perspective but are mostly siloed. Better communication and organized structures serve to generate new ideas, link best practices, provide value added resources and synergy to better support entrepreneurship in the arts and culture in Wyoming communities.

Entrepreneurial capital for the arts and culture exists in many forms. Human capital- faculty in the fine and performing arts at the University and Community Colleges possess knowledge to be shared in communities to help grow the arts and culture. They can provide workshops, courses and certificates in entrepreneurship in the arts to help foster entrepreneurship in the arts in Wyoming communities. Likewise, students at the University and Community Colleges can gain valuable entrepreneurial experience by presenting their art in a community and add to a community's vitality. Finally, local artists provide a crucial cultural focal point and are among a community's most active entrepreneurs. Physical spaces for the arts- most Wyoming communities possess spaces for the arts at the University, Community Colleges, and Arts Organizations. In addition, communities often hold unused spaces that can be converted or remodeled into viable artistic or cultural spaces. Spaces for the arts create cultural centerpieces in communities that have been proven economic generators in other communities.

Corporate giving and grants- financial support for the arts is available through grants. In addition, corporate sponsorship can be a significant support for the arts and infrastructure.

IV. Supporting an Entrepreneurial culture on campus:

Entrepreneurs exist both on campus as students, staff, and faculty and in our communities across the State. For this institution to prioritize the development the broader entrepreneurial community across the State there will need to be changes how we incentivize faculty and students in developing their entrepreneurial capital and how support entrepreneurs on and off campus. This section identifies two types of roles for entrepreneurship at UW training existing students, staff, and faculty on the basics of starting and implementing a new business and secondly assisting and facilitating entrepreneurship development where it occurs, on or off campus.

In the first role, on-campus entrepreneurship/intrapreneurship needs to be seen as an important interdisciplinary exercise where technical scholarship, whether science or humanities, is melded into business and market concepts. This requires that the individual should be allowed to venture from the disciplines that they work in to explore how to translate and transform into a business.

As such there needs to be a formalized incentive system that rewards faculty, students, or staff in developing entrepreneurial concepts. This means that tenure and promotion, student evaluations, and staff evaluations have to have as an alternative some entrepreneurship metrics. It does not necessarily need to be required for all positions but there should be options for faculty and staff to explore those aspects with metrics. Potential metrics that might need to be discussed can include the following.

- What level of entrepreneurship is sufficient? Is a patent enough, or patent plus business plan, or development proposal? That could vary depending upon both the discipline and the Departments expectations.
- The Department and College will need to acknowledge the academic success is not the same as entrepreneurial success. The challenge to get research published can conflict with the time to get entrepreneurship developed.
- What are the demands of the resources and the risks to the faculty or student? Are there ways to minimize that risk?
- A similar set of questions can be addressed for students. Can they get through classes where depth and non-marketable concepts are required to understand the topics all the while thinking about how to extend these to entrepreneurial pursuits?
- Finally, the support of entrepreneurial pursuits needs to be supported all the way up administrative ladder.
- Revenue sharing from an internal entrepreneurial activity can a good incentive, but then the risk associated with the activity might also need to be shared.

The second role, of assisting or supporting entrepreneurs, both on and off campus, is a transdisciplinary exercise. Assist in the production of knowledge, that can inform entrepreneurship both at the technical level and the business development level requires that interdisciplinary framework discussed above. But the practical development of a system that produces a marketable product or services requires a learning and exploration process to understand the science or discipline and the technology to create it. But the transdisciplinary framework as it pertains to faculty assisting and supporting an entrepreneur goes beyond the technical. It a role that is the expert the discipline can guide and only suggest where an entrepreneur might take the idea; what might work or may be constrained by markets or technology costs. It is transdisciplinary because assistance and support requires that the conveyor of scientific or scholarship knowledge has to understand the entrepreneur's own production of knowledge. So in other words, listening is a key skill. Both types of knowledge can be correct.

In this role the institution should allow faculty to assist the entrepreneur in the exploration. It is a teaching exercise by both the faculty and the client. The outcome may not be publishable by the faculty member so it needs to be recognized as a teaching exercise, non-credit as it is. The potential public benefits of this effort as in the case of the internal faculty entrepreneur a similar institutional framework must be established to allow for recognition of this effort.

Finally, both roles need to acknowledge the role of students in the process as partners. The incentive is assuming that the graduate student's time is "owned" by a faculty supervisor. Often that is because the student is on grant funding and in some cases, there may actually be requirements that the student be focused on the funded research. However, the long-term public benefits of exploring an entrepreneurship angle of a research topic could have substantial public benefits whether the student exercises that option or just lays out how that can be translated to a marketable product or service. Graduate students are half time which means the other half is flexible. Learning entrepreneurship can be as important and productive to society as learning through coursework and writing can be. These standards need to be worked out by the Department and in conjunction with graduate students.

That flexibility can be even more acute for undergraduates. Ideas might surface in classes that do not necessarily have an entrepreneurial learning objective but allowing time for students inside or outside of class to explore entrepreneurial ideas can be a very good learning exercise.

Barriers to Implementing a deep Culture of Entrepreneurship and Engagement

For fully successful implementation, a topic to address is that the CULTURE of UW needs to change in order to effectively and successfully roll out an entrepreneurial mindset across the state, driven by UW. Despite the fact that UW was founded as a land-grant institution, and has long had engagement efforts through traditional extension in Agriculture, Education and the Arts, traditional academic barriers exist to supporting engagement and entrepreneurship efforts across other parts of the campus, and these will have to be reduced or removed if the institution is to be truly supportive of state efforts.

Some of the existing problems:

1. UW faculty are not rewarded for any behaviors outside of a direct and specific academic charter defined by the department.
2. The departments have multiple constraints, a major one being accreditation, which doesn't allow much deviation in action.
3. Tenure and promotion are done by vote of "peers", many of whom believe that any commercial activity is a "sell-out" or inconsistent with academic purity.
4. Science, engineering and business faculty in particular are often measured specifically for how narrow and deep their respective expertise is and rewards are often not easily achieved by faculty interested in broader applied research
   a. Publication is often viewed as the only metric that matters to faculty development and effectiveness.
   b. Publication rates in narrow and deep fields matter more. Publication in multiple areas is generally counted against the individual. Pivoting to a new area of research is disincentivized.
   c. Breadth is a handicap and viewed negatively. Interdisciplinary research is often disincentivized both directly and indirectly. Inter and transdisciplinary research often lacks outlets that are perceived to have high ranking within disciplines and are therefore

discouraged for scholars seeking tenure and promotion and by departments incentivized to focus on disciplinary ranking.

    d. External funding seems only to matter if narrow and deep, and raw science based. Some departments almost completely disincentivize pursuit of outside funding (e.g., CoB) as a factor in evaluating faculty effectiveness.

5. Many faculty disincentivize students from pursuing entrepreneurial concepts, in particular if they are graduate students. Many faculty believe the only worthy goal for a graduate student is in becoming an academic.

6. Many faculty will resist insertion of entrepreneurial content into classes as being irrelevant. An example where this has been proven wrong is Arizona State University.

7. Other examples?

UW is not alone or unique in having such structural barriers, and these barriers often arise out of traditional academic incentives and focus. To broaden efforts to support economic development objectives in the state, deeper commitment to such efforts is necessary, and will only occur if faculty, staff and students are not disincentivized from participating in them. Therefore, the structural incentives to spur a new direction need to be established. Department expectations documents for teaching, research/creative activity, and service, must allow flexibility for faculty to engage in entrepreneurial activities that benefit UW and the state's economy. Faculty must not only be incentivized to do this work, but they must also be rewarded for this work. This could begin by including economic development and entrepreneurship activities in workload policy documents and recognizing such efforts in reappointment, tenure and promotion guidelines. Furthermore, engagement and applied research and teaching efforts should be recognized and encouraged in such documents if the institution is to be truly supportive of such efforts in the state. Similarly, staff support for such activity should be encouraged as well – UW should attempt to identify where there issues here as well.

Additionally – incentivization of deep engagement to support economic development and entrepreneurship need not be defined only in job descriptions and expectations, it can also be recognized on campus. Expanded funding and awards for entrepreneurship should be considered to incentivize departmental and unit focus in these areas. Such efforts could, for example, allow faculty to develop programs and curricula that engage in entrepreneurship on campus and in the state, or develop applied research programs that prioritize management, training and policy-development that supports state economic development. Other incentives could also be implemented to develop grater entrepreneurial activity within the institution. Existing programs of revenue sharing could be expanded and development of intellectual property could be reviewed.

Expand this area – how are entrepreneurial efforts by students and staff supported? Many have businesses – how could these be recognized and supported beyond existing programs? Possibly more formal and visible support for students. and staff I these areas could be developed. While existing programs such as entrepreneurship competitions could be continued and expanded, more inclusive means of support for all such efforts could be developed

V. Synergies and Conclusions

The frameworks and foci discussed above can provide a entrepreneurship learning community where entrepreneurs off campus learn from but also inform and teach both faculty and students on campus. For this reason we define entrepreneurship and innovation programs as transdisciplinary. Both are operating in their respective knowledge production systems but they also are having a conversation where each can compare their interpretation with the others.

The role the University plays is not just encouraging internal entrepreneurship but also providing discipline-based information and innovation to assist entrepreneurs in communities out in the State in their efforts to build businesses. Entrepreneurs are by the nature of their activities disruptors and can be seen that way in a community. They may be from outside of the community or State and as such are not plugged into the networks in a community. One would hope that the social capital and networks are developed enough for local leaders to engage in a constructive manner with entrepreneurs, but that is also a program that the University can help facilitate. Training local leaders to build welcoming entrepreneurship ecosystems in our communities requires a special type listening and conversation that is not always obvious to groups of people know each other well.

The goal is build dynamic communities that are welcoming to entrepreneurs and some understanding of what entrepreneurs bring to communities. According to Auresweld (2017), the author of the Kaufman Foundations report on entrepreneurship ecosystems, a community that is ready for entrepreneurs has a leadership base that can listen to and allow entrepreneurs to drive the interactions and conversations. That is part of the transdisciplinary process. The community has at least an intuitive sense of the ecosystem mapping of entrepreneurs in their region. The University and State Agencies can also help understand the mapping and avoid artificial segmentation.

The goal for all is to create livable and engaged communities that welcome and support entrepreneurs. That goal is reachable but requires much effort and coordination between the State, community leaders, the University of Wyoming and the community college system. The local connections between community colleges and community leadership are vital asset in the mapping of social capital in the State. A recent Federal Reserve Bank of St. Louis Study by Hannah Rubinton suggests that attracting entrepreneurs can be a challenging exercise. Even mid-size cities appear to be losing out to large metropolitan areas in attracting young entrepreneurs because of the more developed ecosystems there.

Both the Kaufman Report by Auresweld (2017) and a recent publication by Feld and Hathaway (2020) identify key conditions and strategies for building entrepreneurship ecosystems. Four of the key points that come from both publications are the following:

- Outcomes cannot be mandated by government

- Direct control by government in local decisions will fail to thrive.
- Infrastructure in large demographic communities is seen as a given; Wyoming must develop that infrastructure or the starting point for further growth is dramatically attenuated.
- Entrepreneurship is dependent on factors outside of training, and includes community engagement, access to the arts, culture and a thriving SOCIAL ecosystem that leads to people wanting to contribute and stay in the community, followed by entrepreneurship.

Four above are a portion of the key points in Feld and Hathaway (2020). The complete list is added as an Appendix. The goal is to build the ecosystem within the University, Community Colleges, and cities across Wyoming.

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Appendix

Key factors by Feld and Hathaway (2020). The Startup Community Way – Evolving An Entrepreneurial Ecosystem.

1. Entrepreneurs must lead the startup community.
2. The leaders must have a long-term commitment.
3. Startup communities are complex adaptive systems that emerge from the interaction of the participants.
4. Startup communities can be guided and influenced, but not controlled.
5. Each startup community is unique and cannot be replicated.
6. Startup communities are organized through networks of trust, not hierarchies.
7. The startup community must be inclusive of anyone who wants to participate.
8. Openness, support, and collaboration are critical behaviors in a startup community.
9. The startup community must have continual activities that meaningfully engage the entire entrepreneurial stack.
10. Startup communities must avoid the trap of letting demand for measurement drive flawed strategies.
11. Putting founders first, giving before you get, and having an intense love of place are essential values in a startup community.
12. Startup communities are propelled by entrepreneurial success and the recycling of those resources back into the next generation.
13. The best startup communities are interconnected with other startup communities.
14. The primary purpose of a startup community is to help entrepreneurs succeed.