

Edward Crawley
John Hegarty
Kristina Edström
Juan Cristobal Garcia Sanchez

Universities as Engines of Economic Development

Making Knowledge Exchange Work

 Springer

Laspaui Affiliated with
Harvard University



Second Higher Education Summit of the Americas

June 10th & 11th, 2021

Universities
as Engines
of Economic
Development

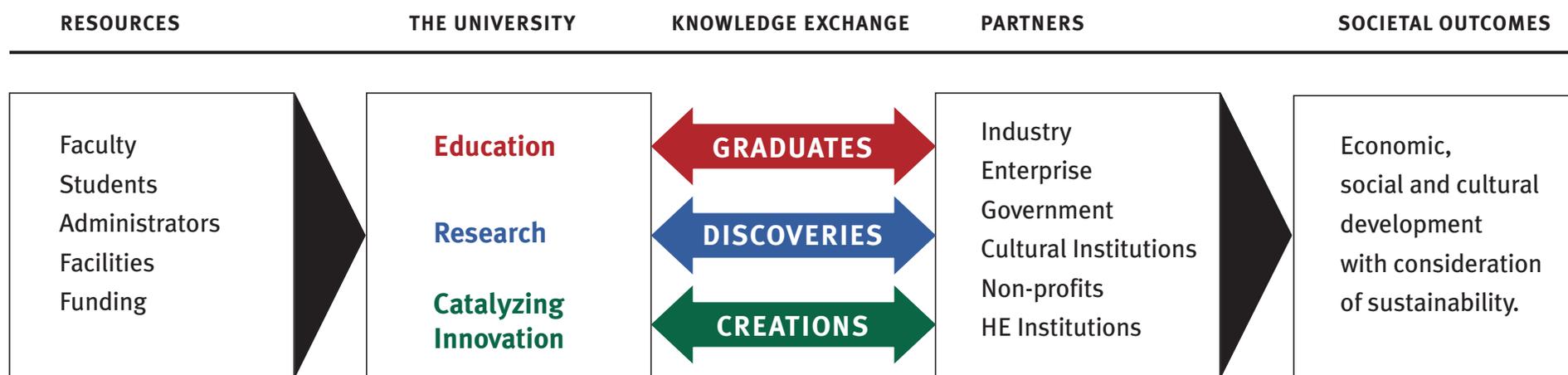
Making Knowledge Exchange Work

Introduction

Universities as Engines of Development

- Societies face challenges from small to grand
- Established universities contribute greatly to sustainable development of society, but could do more, and new universities can be created
- All universities are all trying to strengthen their support of social and cultural development, but the topic of especially intense interest - **sustainable economic development**

The university outcomes that eventually lead to societal benefit, emphasizing the central role of knowledge exchange.



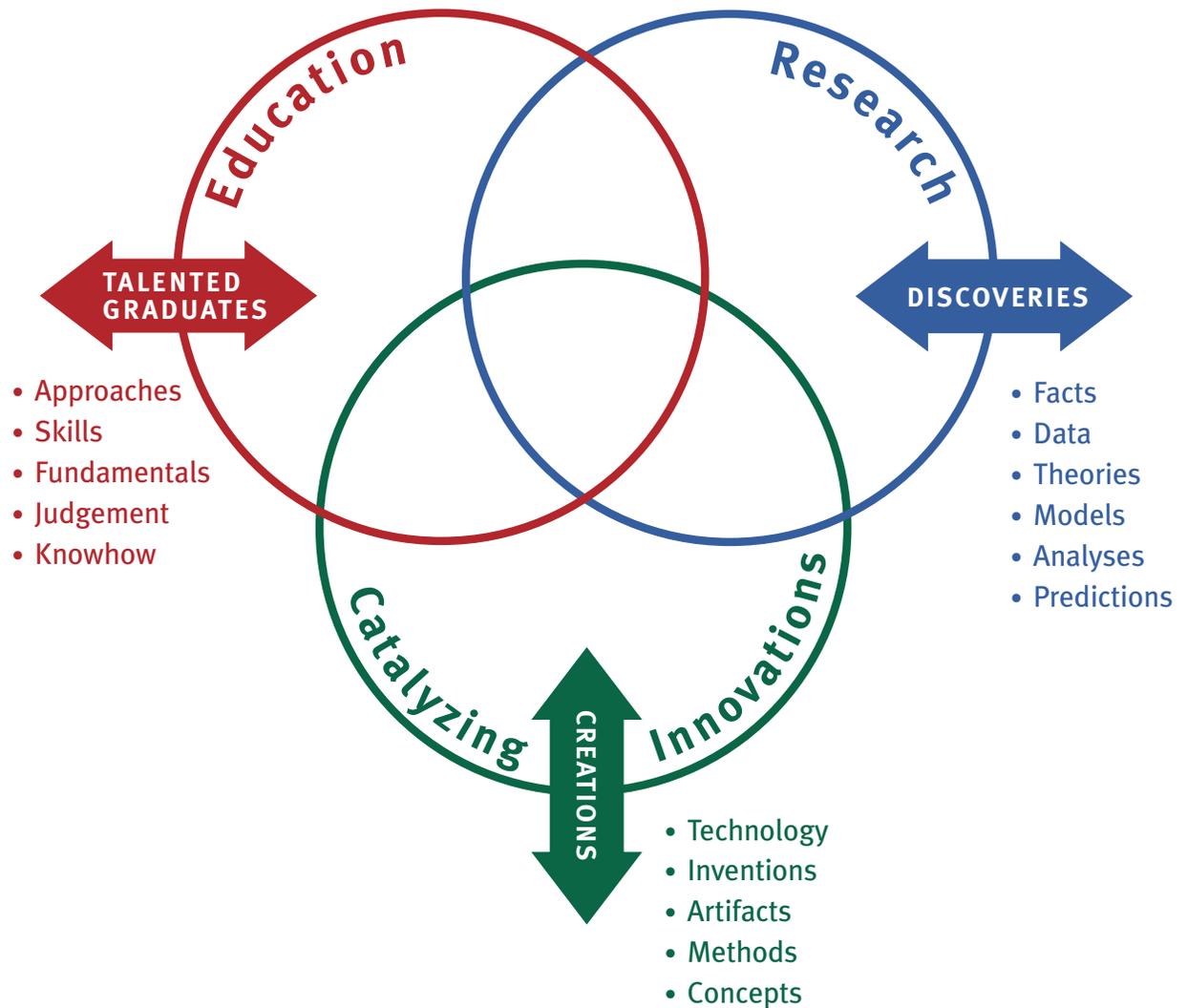
Hierarchy of outcomes on the path from the actions of universities to economic development



Knowledge Exchange is the key

- Universities act as engines of economic development when they help to **accelerate innovation** in industry and enterprise through **knowledge exchange**
- Knowledge exchange is the **two way exchange of people and ideas** with partners at porous boundaries.
- Activities that strengthen knowledge exchange can be built into **effective practices in education, research and catalyzing innovation**, and enable their **outcomes – graduates, discoveries and creation**

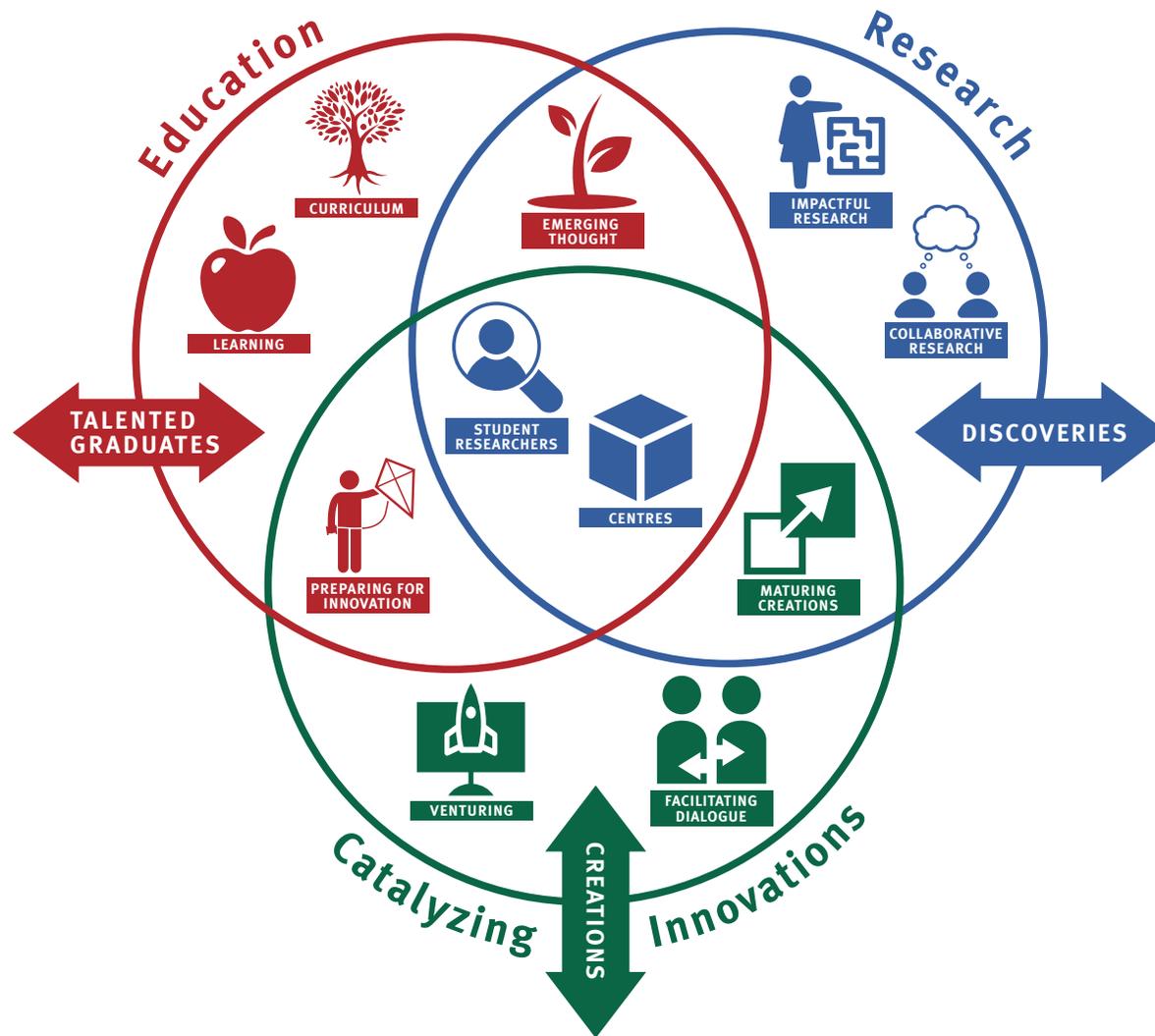
The outcomes of the three academic domains —and how knowledge is exchanged



Pragmatic Actionable Agenda

- **Systematic approach:** identify needs, consider needs, proactive process to exchange outcomes
- Concrete integrated **academic practices** that yield the outcome for exchange
- Framework for an **adaptable university** – supporting practices, evaluation, alignment and change

The eleven academic practices



Case studies from institutions all over the world



List of institutions

Aalborg University
Australian National University
Arizona State University
Cambridge - MIT Institute
Chalmers University of Technology
edX (Harvard & MIT)
École Polytechnique Fédérale de Lausanne
European Research Council
Harvard University
Hong Kong University of Science and Technology
Indian Institute of Technology Delhi
Imperial College London
Korea Advanced Institute of Science and Technology
King Abdullah University of Science and Technology
KTH Royal Institute of Technology
Massachusetts Institute of Technology
Nanyang Technological University
Olin College of Engineering

Osaka University
Pontificia Universidad Católica de Chile
Royal Academy of Engineering
Singapore University of Technology and Design
Skolkovo Institute of Science and Technology
Stanford University
Technical University of Denmark
Technical University of Munich
Technion – Israel Institute of Technology
Tecnológico de Monterrey
Trinity College Dublin
Tsinghua University
UK Research Excellence Framework
University College London
University of Cambridge
University of Colorado Boulder
University of the Witwatersrand in Johannesburg
University of Toronto

Universities
as Engines
of Economic
Development

Making Knowledge Exchange Work

Practices: Education, Research and Catalyzing Innovation

Education and knowledge exchange – the most valuable contribution

- Outcome: talented graduates
- *Objective*: develop the potential for students to lead fulfilling lives, contributing to society, acting as agents of knowledge exchange and innovation
- Students need to develop deep working knowledge of disciplinary fundamentals infused with the skills, approaches, and judgement that enable them to access both existing and new opportunities
- They need to develop essential life and professional skills, including know-how in research and innovation

Education and knowledge exchange

Practices, processes and outcomes



CURRICULUM

INTEGRATED CURRICULUM

- Courses, projects and co-curricular experiences.
- Graduating talent with fundamentals and skills.



LEARNING

TEACHING FOR LEARNING

- Active, experiential and digital learning.
- Graduates with deep understanding and self-efficacy.



EMERGING THOUGHT

EDUCATION IN EMERGING THOUGHT

- Quick migration of cross-disciplinary & emerging thought.
- Graduates at the frontier of knowledge and technology.



PREPARING FOR INNOVATION

PREPARING FOR INNOVATION

- Learning leadership, management and entrepreneurship.
- Graduates better prepared to be innovators.



Integrated Curriculum

is about setting learning objectives informed by stakeholder input, and deploying integrated curricular elements including courses, projects, and co-curricular experiences.

CURRICULUM

Key Actions:

- Engaging with communities of stakeholders – e.g. graduates, employers, government, faculty and students – to inform the definition of intended learning outcomes
- Designing mutually supporting disciplinary courses and projects, to achieve progression and connections throughout the program
- Explicitly integrating essential skills with disciplinary fundamentals, so that skills support the learning of fundamentals, and the fundamentals provide the context for developing the skills
- Encouraging co-curricular activities, including involvement in on-campus research and innovation, and pre-professional and off-campus experiences



LEARNING

Teaching for Learning

is about deploying teaching and assessment approaches which align with intended learning outcomes, engage students' attention and curiosity, and involve active, experiential and digital forms of learning

Key Actions:

- Constructive alignment of intended learning outcomes, learning activities that support learning of skills and fundamentals, and assessment activities
- Active learning, engaging students in manipulating and evaluating ideas, and experiential learning in situations resembling working life, leading to the development of self-efficacy
- Digital learning – so that students can access many resources and points of view, blended with face to face learning
- Encouraging self-learning – the ability to reflect on past experiences, identify and satisfy the individual's need for new knowledge and skills



PREPARING FOR
INNOVATION

Preparing for Innovation

is about supporting student development of the advanced skills and knowledge needed to become effective innovators: leadership, management, innovation, and entrepreneurial skills, and an aptitude to be curious, identify opportunities, and take appropriate risk

Key Actions:

- Learning in innovation and entrepreneurship which focuses on how to support the entire product life-cycle, along with the creation of a new ventures
- Learning how to manage the development and deployment of technology, within a specific technology and market sector
- Learning the skills to make sense of complex situations, rally others, create visions and work relentlessly to deliver solutions that address common goals

Research and knowledge exchange – increased understanding of our world

- Outcome: discoveries
- *Objective:* make discoveries – often revealing phenomena or truths that have previously existed but were unknown or unexplained
- Make discoveries at the frontiers of knowledge that have the potential for becoming more impactful instruments of knowledge exchange and innovation
- Proactive approaches include joint projects, personnel exchange and involvement with professional development. And, graduates carry knowledge of discoveries to future work

Research and knowledge exchange

Practices, processes and outcomes



IMPACTFUL RESEARCH

IMPACTFUL FUNDAMENTAL RESEARCH

- Pursuing curiosity-drive and use-inspired discoveries.
- New knowledge with impact on scholars and society.



COLLABORATIVE RESEARCH

COLLABORATIVE RESEARCH

- Collaborating with internal and external scholars.
- Discoveries across disciplines and in new fields of thought.



CENTRES

CENTRES

- Empowering Centres of Research, Education & Innovation.
- Directly implementable and impactful solutions.



STUDENT RESEARCHERS

STUDENT RESEARCHERS

- Engaging undergraduate and postgraduate researchers.
- Preparing researchers and agents of knowledge exchange.



Impactful Fundamental Research

is a research process that seeks fundamental discoveries, whose motivation lies along a spectrum, from curiosity-driven to use-inspired.

The main outcomes are discoveries that are broadly impactful on other scholars, on the issues of society and economy, or on both

Key Actions:

- Granting researchers the freedom and associated responsibility to undertake fundamental research along the spectrum from curiosity-driven to use-inspired
- Scanning for addressable fundamental issues of society and the economy; engaging with external counterparts to develop mutual understanding; and considering the potential impacts of the discoveries
- Disseminating outcomes to the scholarly and partner communities to increase impact
- Communicating with policy and funding bodies about the nature of impactful fundamental research and relevant timescales of impact

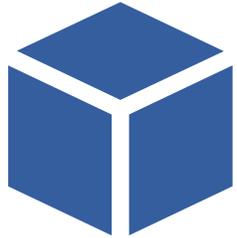


Collaborative Research

within and Across Disciplines involves scholarly researchers from diverse fields, approaches and sometimes institutions. They collaborate to make discoveries and exploit emerging ideas and technologies, often at the edges of existing disciplines and in new emerging fields of thought

Key Actions:

- Collaborating across disciplines and approaches to bring in different methods and viewpoints
- Collaborating around complementary resources, particularly large capital facilities, data sets and funding
- Setting high expectations on the value of outcomes, so that the benefits outweigh the difficulties of geographic distribution or institutional barriers
- Conducting frequent in-depth interaction and exchange to facilitate collaboration and build relationships of knowledge and trust



CENTRES

Centres

are research communities that bring together scholars, experts from industry, government, and other groups. They advance the production of directly implementable and impactful solutions in research, education and innovation

Key Actions:

- Identifying the key issues to address, motivated by needs of society and overarching “grand challenge” goals
- Building an integrated community of university researchers and students, industry, government, regulators, public interest groups and others, working together in close partnership
- Developing outcomes at an accelerated pace, and testing them in realistic environments
- Structuring an effective and well-defined organization to lead projects, manage interactions, and attract resources.



STUDENT
RESEARCHERS

Students Researchers

is the process of mentoring research students by involving them in a progression of research responsibilities, including work with partners and the assessment of the innovation potential of the research

Key Actions:

- Engaging postgraduate students in the mainstream of research, sometimes with partners, mentoring their development, and recognizing their contributions to publications and in scientific forums
- Involving undergraduates in research partnerships with faculty as part of the faculty's research, or in student proposed research and innovation activities
- Systematically including in each student's thesis an assessment of the innovation potential of the emerging research discoveries

Catalyzing innovation and knowledge exchange – the most valuable contribution

- Outcome: creations
- *Objective:* produce creations – synthesized objects, processes and systems that have never existed prior to their development at the university, and that have potential for societal impact.
- Mechanisms include publications, discussions, joint projects, personnel exchange, intellectual property and tangible research property agreements, exchange of tangible artifacts, and involvement in startups and consulting.
- Knowledge exchanged flows from the university's cross-disciplinary and integrated activities, including education, research and catalyzing innovation.

Catalyzing innovation and knowledge exchange

Practices, processes and outcomes



MATURING DISCOVERIES AND CREATIONS

- Progressive invention, market analysis and demos.
- Creations with higher technology and market readiness.



FACILITATING DIALOG AND AGREEMENTS

- Informal dialog and formal agreements.
- More creations adopted by partners.



ENTREPRENEURIAL VENTURING

- Real entrepreneurial process within university.
- New ventures and more experienced entrepreneur.



Maturing discoveries and creations

is a progressive approach that matures university discoveries and creations through a process of invention, intellectual property protection, market and business analysis, and proof-of-concept demonstration

Key Actions:

- Identifying and consolidating a creation with potential market impact by creating a prototype, proof of principle or invention, and seeking IP protection
- Identifying and assessing the potential commercial impact of the creation in a specific market, product or system application, or business opportunity
- Conducting a proof-of-concept demonstration to mature the creation and validate it in the context of a potential market, closing the readiness gap



Facilitating Dialog and Agreements

provides systematic and proactive support of the effective adoption of university creations by partners. It includes technology licensing, support for partners learning about creations, and facilitation of informal multidirectional exchanges

Key Actions:

- Universities learning about the long-term needs of companies through systematic dialog with partners
- Partners learning about the outcomes of the university through events and demonstration days, guided visits, survey presentations and access to digital archives
- Exchanging knowledge with partners through open and trustful long-term relationships, growing from discussions, joint projects and personnel exchange
- Exchanging knowledge with partners through the formal mechanism of agreements on IP (Intellectual Property) and TRP (Tangible Research Property) and funding



Entrepreneurial Venturing

supports the process of venture creation within the university by faculty, staff, students and post docs, through development and mentoring of new entrepreneurs, and through university facilitated access to discoveries and creation, incubators and facilities, seed funding and professional networks

Key Actions:

- Developing new entrepreneurs through a combination of structured frameworks, repeated pre-entrepreneurial experiences, and mentoring
- Enabling successful new ventures based on knowledge outputs, the expertise of the faculty, and the integrative and enthusiastic efforts of students
- Providing access to incubators, workshops, capital equipment and small amounts of university or investor funding
- Supporting professional entrepreneurial networks designed to share insights among entrepreneurs, faculty, staff, students, post docs, alumni, investors and suppliers

Universities
as Engines
of Economic
Development

Making Knowledge Exchange Work

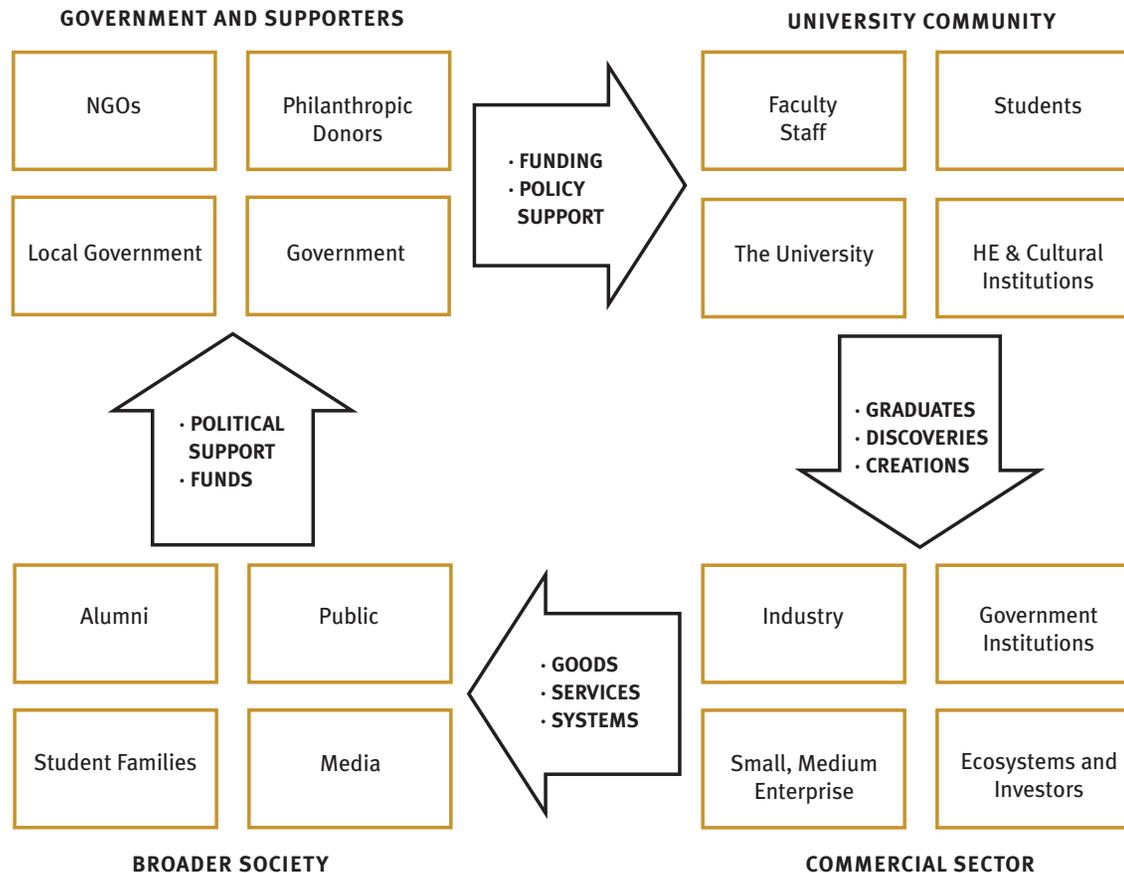
The Adaptable University

Supporting practices

The practices that support the academic programs

Practice name	Description of the practice > and its outcome
Engaging Stakeholders	Engaging with and learning the needs of the expanded set of stakeholders associated with economic development > leading to strategy and programs more likely to address stakeholder and university needs
Evolving Culture	Evolving the university's culture and values > encouraging the activities leading to economic development
Mission and Strategic Planning	Revising the university's mission, strategy and priorities > focusing on its investment of resources, and communicating how the university will contribute and distinguish itself, including in innovation
Governance	Updating decision making, policies, organizations and budgets > promoting a clear definition of devolved authority and the transparent decisions necessary to support the strengthened role in innovation.
Faculty and Staff Resources and Capabilities	Recruiting and developing high quality faculty members and professionals > yielding a university community better able to undertake the tasks and programs linked to innovation
Academic Facilities	Providing functional, flexible facilities – classroom, social spaces, laboratories, workshops and IT connectivity > enabling activities in learning, innovation and collaborative research with industry

Circular flow of outcomes in a stakeholder network



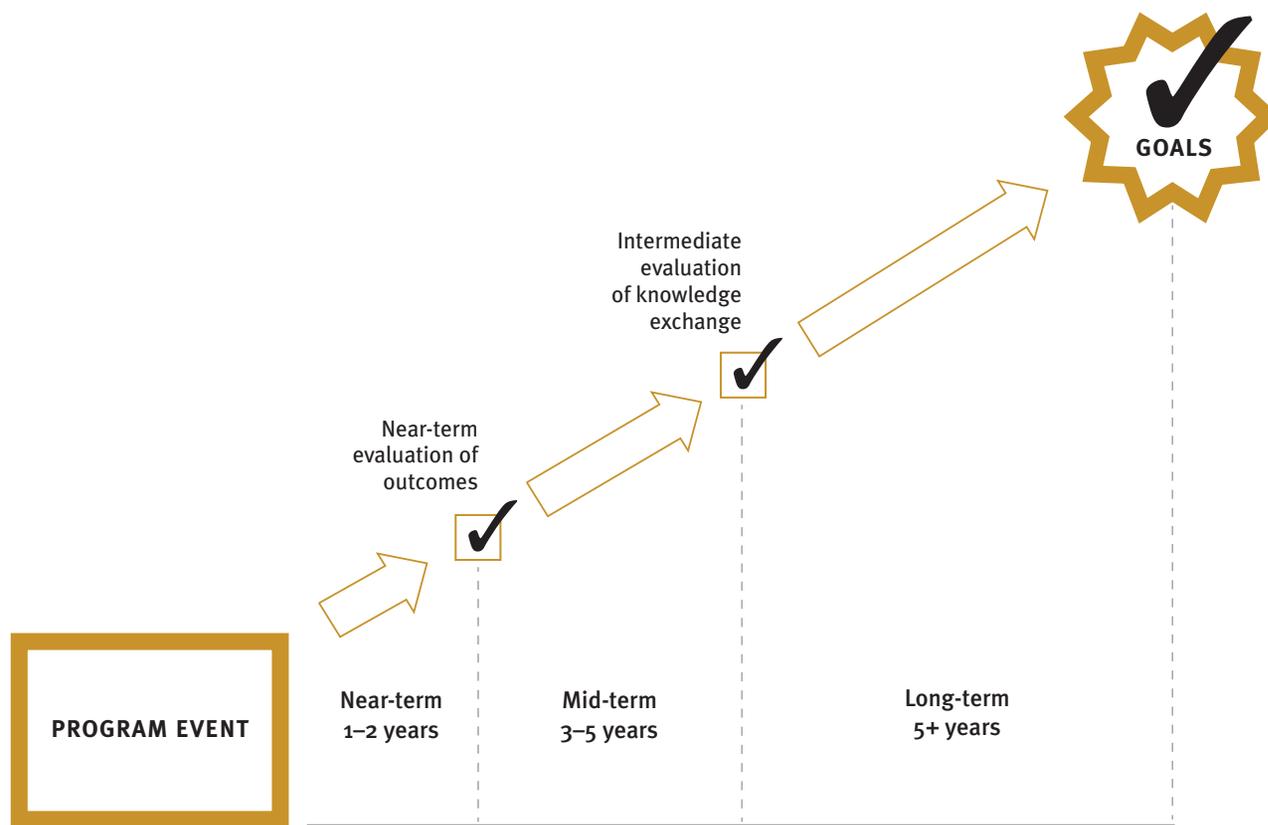
View of faculty and staff resources and capabilities: traditional (dark shade) vs expanded (light shade)

	Education	Research	Innovation
Faculty	++	++	+
Research Staff		++	
Lecturers and Instructors	++		
Professors of Practice	+	+	++
Innovators in residence	+		++
Knowledge Exchange Professionals		++	++

The practices of evaluation and expectations

Practice name	Description of the practice > and its outcome
Program Evaluation	Collecting evidence that reflects the university goals, and evaluating success of programs or units > Demonstrating the effectiveness and contributions of the university and inspiring action to improve.
Faculty Expectations and Recognition	Establishing expectations and recognizing accomplishments of individuals in education, research, innovation and knowledge exchange > Better aligning the actions of the faculty with the university goals.

A framework for near-term evaluation of outcomes and intermediate evaluation of knowledge exchange



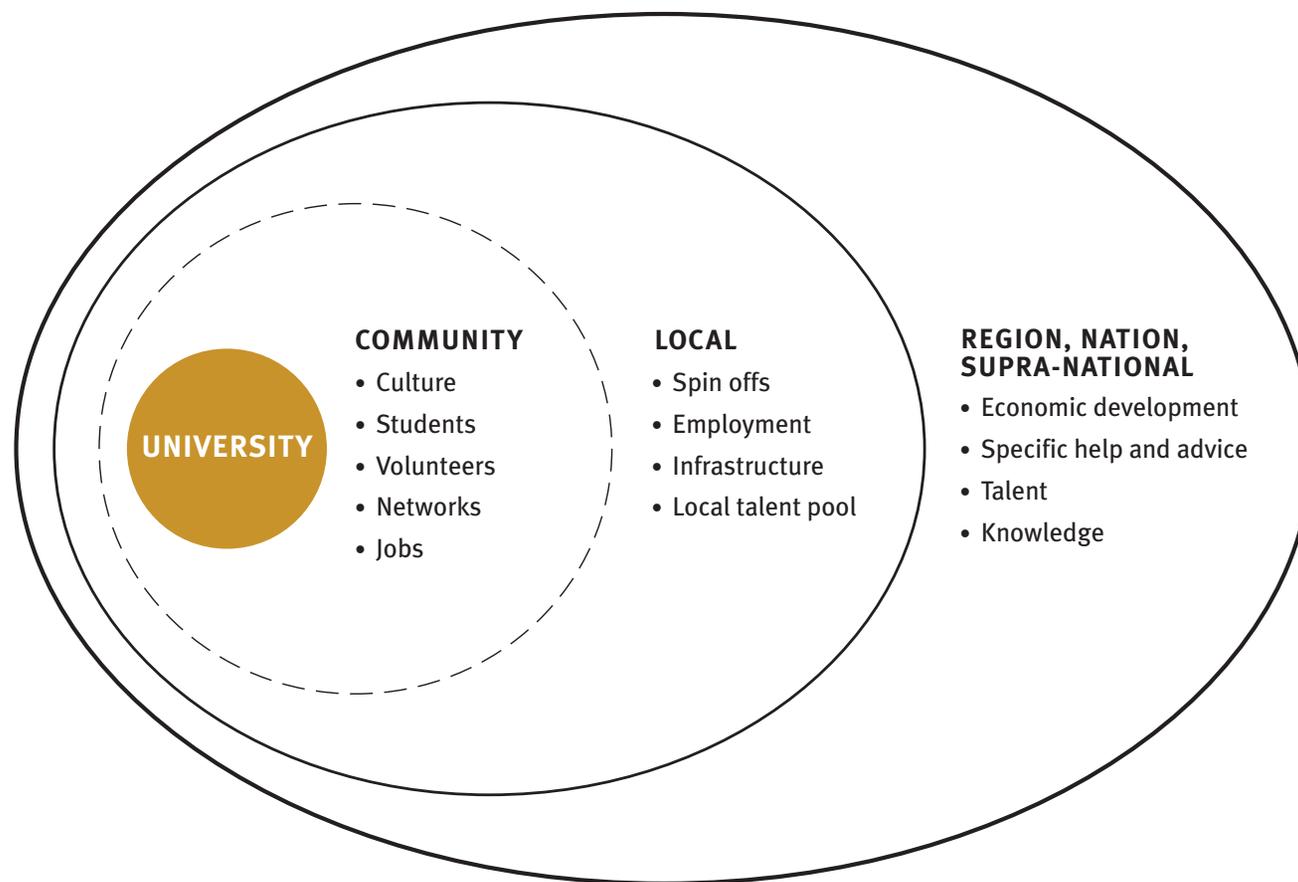
The practices for partners in aligning with universities

Practice Name	Description of the practice > and its outcome
Understanding the University's Needs and Capabilities	Participating with the university in high level and engaging dialogue > building a better understanding by partners of the needs, capability, culture, offerings and strengths of the university
Building the University's Capacity to Contribute	Helping to define educational outcomes, engaging in research and innovation projects, providing mentors, advising on policy, and contributing financially > increasing building the university's capacity to contribute
Developing the Partner's Capacity to Absorb	Assigning to liaison roles personnel who can facilitate knowledge exchange between the university and the partner's organization > accelerating the effective absorption and employment of the university's talented graduates, discoveries and creations

Approaches for partners in aligning with universities

	Partners improving their understanding of universities	Partners supporting the development of universities' capacity	Partners absorbing beneficial universities' outcomes
Alignment by industry, and small and medium enterprise	High-level dialog to acknowledge differences and seek an array of interactions with common benefit	Industry provides human, technical, and financial resources for programs that address industrial and enterprise needs	Industry absorption is managed by an engagement team that includes a senior leader, and specialists in HR, technologies and markets
Alignment by government and community	Dialog to address tensions and develop interactions and programs of mutual benefit	Government creates supportive policy and provides core support for education, research and innovation	Each level of government has a liaisons that help absorbs university outcomes and oversee the flow to society of others
Alignment by philanthropies and alumni	Broad dialog to align the goals of philanthropies and alumni with the aspirations of the universities	Philanthropies provide targeted funding that often allows universities to nucleate new ventures and facilities	Philanthropies and alumni gain no direct benefit, but their efforts address their goals and produce impact in society

Alignment with government and community



Cultural factors that support change in universities

Factor	Rationale
Collegiality and consensus	Faculty want to be involved and consulted, and participate in consensus. Similarly, students can add creativity and ground truth, and administrators can contribute wisdom.
Thought leadership	Faculty value proposals that are intellectually argued and well-thought-out. This follows from the value we attach to critical thinking and to challenging accepted notions.
Evidence	Arguments presented without sound evidence will generally be rejected. This follows from the value we attach in research to the importance of evidence in supporting or rejecting hypotheses.
Benchmarking	Universities respect their peers, and faculty and leaders are normally open to learning from those who are seen as aspirational peers.
Impact	Faculty genuinely desire to see the impact of their intellectual contributions, and the change process is an opportunity to reflect on and strengthen their pathway to impact.
Piloting	Bottom-up processes capture the innate creative nature of faculty in education, research and innovation, and the value and joy of experimentation.
Timescale	Every practice in a university has a natural pace and timescale. Change processes can be adapted to effectively benefit from this pace.

Managing change in universities

Action	Objectives
Thoughtful leadership and vision	To articulate a compelling intellectual vision, engage the community and stakeholders, and communicate
Chartering an effective task force	To visibly empower a task force that will listen to all and design an implementation plan for change
Allocation of adequate resources	To provide sufficient sustained resources to cover the time of the task force and other key people, and the cost of pilot studies, monitoring and iteration
Success at the first steps of staged implementation	To plan change in phases, focusing attention and resources on earlier success, while allowing mobilization for coming stages.
Regular monitoring of progress towards full adoption	To identify bottlenecks and successes, to guide further development, and support full adoption of the change

Characteristics of successful university systems

Characteristic	Rationale
Ambitions	The system must have ambitions that are more than the sum of the parts – there must be benefit to scale and synergies
Complementary missions	Each institution should focus on topics within its mission and strengths – a system of complementary institutional missions will better provide efficient coverage of all needs
Differentiation	The system must allow certain areas at some institutions to excel and gain excellence, collecting thought leaders and educating future leaders
Competition	Institutions naturally compete for faculty, students and results. Competition avoids complacency and stimulates development
Collaboration	Universities and groups at universities often collaborate to take advantage of complementary perspectives, scholars and capital assets

Phased startup of the academic practices at a new university

PHASE 1		PHASE 2		PHASE 3
INTEGRATED CURRICULUM	›	Preparation for Innovation Teaching for Learning	›	Emerging Thought
IMPACTFUL RESEARCH	›	Collaborative Research Student Researchers	›	Centres
MATURING CREATIONS	›	Facilitating Dialog	›	Venturing

Edward Crawley

Massachusetts Institute of Technology
77 Massachusetts Avenue
Cambridge, MA 02139
crawley@mit.edu

Thanks!

Universities as Engines of Economic Development

Making Knowledge Exchange Work