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## The Land-Grant University's Role in Lifelong Workforce Development in Food, Agriculture, and Natural Resources: Leveraging the Relationship between Academic and Extension Programs

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## **The Land-Grant University's Role in Lifelong Workforce Development in Food, Agriculture, and Natural Resources: Leveraging the Relationship between Academic and Extension Programs**

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# The Land-Grant University's Role in Lifelong Workforce Development in Food, Agriculture, and Natural Resources: Leveraging the Relationship Between Academic and Extension Programs

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**Abstract.** Today's food, agriculture, and natural resources (FANR) workforce is constantly evolving. Lifelong learning is no longer a lofty goal but is now a necessity. Colleges of agriculture at land-grant universities have the potential to meet the lifelong learning needs of the FANR workforce. In this article, we present a model where the academic and Extension components of colleges of agriculture at land-grant universities can link together to provide seamless lifelong workforce development. Our model is built on workforce development theory and is based on the traditions of the land-grant universities evolving to meet the needs of the people. Our model can serve as the catalyst for meaningful discussions at each land-grant university about meeting workforce development needs.

Employers are looking for potential employees with a well-rounded education who can help them with hands-on application of ideas and independent thinking in the workplace (Finley, 2023). Companies are also seeking candidates who can apply a wide range of knowledge and skills to real-world issues across all disciplines (Finley, 2023). When asked which skills were the most important in a strong applicant, the top skills listed by employers were those candidates who had strong oral communication skills, were adaptable and flexible, could work effectively in teams, could utilize critical thinking skills, and were motivated and took initiative (Crawford & Fink, 2019; Finley, 2023). Since 2018, many of these same skills have still topped the list of employers. Still, employers seek creative and innovative candidates who can solve complex problems and work effectively with those with diverse backgrounds. More recently, companies are looking for graduates with skills to use emerging technologies, including artificial intelligence (AI) (World Economic Forum, 2023). Colleges and universities have been challenged to adapt curricula to prepare students better to meet employer expectations (NRC, 2009). However, both companies and individuals recognize the importance of continuous learning after a person enters the workforce (Burns, 2020). *Lifelong learning* is no longer a lofty goal but is now a necessity. Colleges of

agriculture at land-grant universities have the potential to meet the lifelong learning needs of the agricultural workforce.

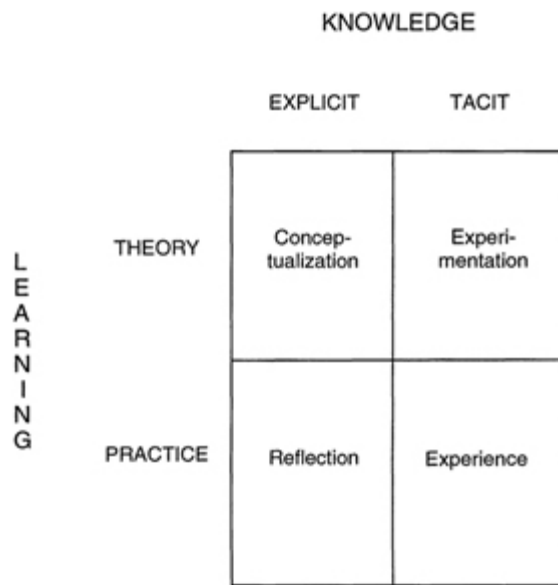
## PURPOSE

The purpose of this article is to propose a model that shows how land-grant universities can seamlessly link academic and Extension programs to provide lifelong workforce development in FANR. Such a model can serve as the catalyst for meaningful discussions at each land-grant university about evolving to continue meeting the needs of the people in their states.

## WORKFORCE DEVELOPMENT MODELS

### RAELIN'S WORK-BASED LEARNING MODEL

Raelin's (1997) work-based learning model illustrates how *theory* and *practice* learning models are combined in both *explicit* and *tacit* forms at the *individual* level (Figure 1). Raelin's work-based learning model describes the integration of theory and practice, where Raelin argues that learning is most effective when individuals can apply theories to real-life scenarios. This model proposes that work-based learning starts with conceptualization, where theory is learned



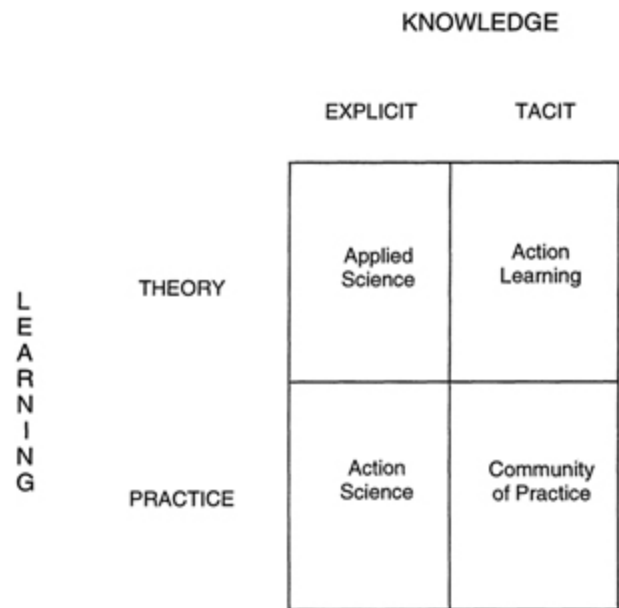
**Figure 1.** A model of work-based learning at the individual level (Raelin, 1997).

explicitly. Next, learners should experiment, where they engage conceptualized knowledge in a way that becomes contextual. Experimentation allows learners to build their understanding of the knowledge by testing it in personally relevant situations (Coleman et al., 2024). Experience is required to reinforce the tacit knowledge found in experimentation (Coleman et al., 2024). Lastly, reflection is necessary to bring the tacit knowledge gained through experience to the surface (Coleman et al., 2023; Raelin, 1997). Many educational programs are designed using a process like the one outlined in this model.

In contrast, Raelin (1997) also proposes that at the *collective level*, four different types of learner actions are displayed in the matrix (Figure 2). The collective level focuses on the needs of the organization and the broader workforce. Integrating these actions produces effective, efficient, and critical learning (Raelin, 1997). Applied science refers to spontaneous inquiry relating to conceptualization. In action learning, real-life experiences, especially those occurring in one’s own context, constitute the primary subject matter. A community of practice occurs when practitioners come together to assist one another with constructing shared understandings. Finally, action science is used to bring about the group and individual’s mental models into consciousness (Raelin, 1997). The learning actions outlined in this version of the model are likely to occur after someone enters the workforce and is immersed in a real-world context.

**COMPETENCY-BASED TRAINING MODELS**

Workforce development is often framed around the competencies employees need (Mulder, 2017). Competency-based models unite individual and organizational (collective)



**Figure 2.** A model of work-based learning at the collective level (Raelin, 1997).

contexts (Mulder, 2017). Integrating competency-based models into an organization is vital to combine educational training with labor market needs (Van der Klink & Boon, 2002). McClelland (1973) advocated using competency-based training models, describing deficiencies in traditional academic models where academic tests determine proficiency. Like the work-based learning model (Raelin, 1997), competency-based training can be approached individually and collectively.

At the individual level, two outcomes of competency-based education have been heavily researched: employability and wage premiums. De Vos et al. (2011) researched the connection between competence development and career success and concluded that engaging in competency development programs is positively related to career success. Much research has been completed tying increased wages to increased cognitive competencies (Ananiadou et al., 2004; De Anda & Hernandez, 2007; Kelly et al., 2010; Murnane et al., 2000). Competency development often begins when someone is enrolled in formal educational programs (K–12 and postsecondary) and continues throughout their career.

**FORMAL EDUCATION SYSTEMS AND WORKFORCE DEVELOPMENT**

The role of formal education in workforce education occurs in secondary schools, community colleges, and universities, typically characterized by the awarding of some kind of credential (diploma, degree, etc.) upon completion. Formal education has replaced the traditional apprenticeship model, which has all but vanished in the United States, with only 0.2% of the workforce participating in an apprenticeship (Newman & Winston, 2016). Career and technical education

# The Land-Grant University's Role in Lifelong Workforce Development

and career-focused programs in secondary education provide an introduction through exposure and initial training in these workforce development areas. Community colleges and technical schools have workforce development as a significant part of their mission. Colleges and universities continue to provide students with advanced skills, career training, and career skills to meet requirements for entry into certain careers. There has been a shift in the balance of the types of schooling people seek to develop their workforce skills, with more of the population attending and receiving college degrees. According to the U.S. Census Bureau, the percentage of high school graduates rose from 41.1% in 1960 to 90.9% in 2022, and the percentage of college graduates rose from 7.7% to 37.5% over that same time (U.S. Census Bureau, 2023).

The last three decades have seen an increase in globalization, automation, and digitization that have changed the job market in the United States (Cheng et al., 2018). Automation is projected to result in 30% of U.S. workers needing to seek new jobs or update their skills by 2030, and jobs that currently do not exist will be held by 65% of today's primary school students (Cheng et al., 2018). Rapid changes in technology and globalization of the economy affect the ability of secondary schools to prepare students to enter the workforce directly. Secondary schools may not have the flexibility in their curricula nor the ability to expand required coursework beyond a typical four-year program to continually evolve to meet workforce demands. Consequently, students will likely need additional training through a technical school or university to gain the skills employers seek. Additionally, the U.S. economy has seen a shift from production to service sectors, which requires an adjustment in expectations for entry-level skills from repetitive tasks requiring basic education to complex tasks that require employees to seek information to solve problems (Perry & Wallace, 2012). A coordinated effort between government, secondary schools, and workforce development is needed to ensure students are equipped with the necessary skills for postsecondary education or entering the workforce. Many states have launched programs, such as CareerWise Colorado to support workforce development aligned with the private industry's needs (Cheng et al., 2018). Florida's Statewide Workforce Development program partners with communities, industry, and Florida school districts to produce and retain Florida's workforce. All states receive federal funding for career and technical education (CTE) through the Carl D. Perkins Vocational and Technical Education Act to further develop both academic and CTE skills of secondary and postsecondary students enrolled in CTE programs (O'Lawrence, 2017). This funding helps fuel partnerships between secondary education and the workforce by establishing career academies, technical preparation programs, early college high schools, and school-

based enterprises (Perry & Wallace, 2012). The U.S. economy is increasingly technology-driven, which demands new skills and a new educational approach. However, as noted by Cheng et al. (2018), a bachelor's degree may no longer be sufficient for someone to have a promising career over their working lifetime. People will need to rely on additional education forms after entering the workforce. Extension has been helping fill this need in the agriculture sector for over a century.

## EXTENSION AND WORKFORCE DEVELOPMENT

The evolution of Extension in the United States extends beyond its historical roots, encompassing a crucial role in shaping the future workforce in agriculture and related fields. As production agriculture transformed, Extension's role in workforce development also evolved. Extension has become a disseminator of research-based information and a key player in preparing the workforce for the challenges of a rapidly changing agricultural landscape (Hatch et al., 2018).

Extension has progressively emphasized education and training initiatives to provide individuals with the expertise and information essential for various positions in agriculture and its associated sectors (Hatch et al., 2018). Becoming a globally premier nonformal educational institution, Extension caters to conventional agricultural issues and the changing requirements of a more inclusive workforce, including both urban and rural communities (Hatch et al., 2018). By organizing and conducting educational activities, Extension is a vital link between the land-grant universities and the workforce, facilitating the transfer of new knowledge and innovative technologies. Extension has been exceptionally adept at reaching people who might not otherwise have any interactions with the land-grant university.

In recent years, Extension programs have played a pivotal role in supporting workforce development initiatives, targeting farmers, professionals, and practitioners in agriculture and related sectors (Hatch et al., 2018). Initiatives like the Integrated Crop Management Conference and statewide training programs in Iowa demonstrate a commitment to training certified crop advisers, Extension specialists, agronomists, and other professionals. These programs respond to the demand for a skilled workforce capable of navigating the complexities of modern agriculture, addressing issues such as sustainability, technology integration, and environmental stewardship (Al-Kaisi et al., 2015).

Furthermore, the involvement of Extension with large-scale farmers and agribusinesses demonstrates a keen understanding of the evolving dynamics within the agricultural workforce (Hatch et al., 2018). By offering education and training tailored to the needs of agricultural professionals, Extension contributes to developing a

workforce that can effectively meet the emerging challenges of a globalized and technologically advanced FANR sector. As the role of Extension continues to evolve, its commitment to workforce development ensures that the next generation of agricultural professionals is well-equipped to contribute to the sustainability and success of the industry (Al-Kaisi et al., 2015).

## MICRO-CREDENTIALING

Micro-credentialing is a valuable tool for enhancing competency-based education. Although there is no clear definition of micro-credentialing, it typically involves a short-term education experience that results in awarding some kind of badge or credential (Brown et al., 2021). Given today's rapidly evolving digital world, micro-credentialing is necessary for lifelong learning in the workforce (Brown et al., 2021). It allows individuals to gain specific skills and knowledge in a shorter period while also providing employers with a way to verify an individual's competency in specific areas of expertise. The credentials landscape is undergoing significant changes, marked by the rapid addition of new competency-based credentials alongside degrees and certificates. However, it is important to note that competency-based credentialing, particularly through continuing education (CE), has been part of the continuum for the past six decades (Fong et al., 2016; Matkin, 2018). However, an emerging trend is the prioritization of different credentials (McGreal & Olcott, 2022).

Employers have an increased interest in hiring people with not only a college degree but also micro-credentials (Finley, 2023; Olcott, 2022). A recent study showed that 68% of employers preferred hiring recent college graduates with micro-credentials (Finley, 2023). This may be because universities face challenges aligning their curricula and corresponding assessments with the emerging needs of employers (Hills et al., 2003; Jorre de St Jorre et al., 2021). Differences exist between the skills students learn and what is assessed (Hills et al., 2003). Even when universities incorporate experiences like internships, the relevance of assessments to workplace practices is often unclear, and communicating the competencies learned is often challenging (Ajjawi et al., 2020; Jorre de St Jorre, 2020). Studies reveal that neither students nor employers tend to link college assessments directly to employability skills (Kinash et al., 2016; Jorre de St Jorre & Oliver, 2018). Employers also have decreased confidence in higher education, with a 21% decrease since 2015 (Finley, 2023). Traditional higher education programs are becoming increasingly criticized for multiple reasons, but the lack of alignment with workforce needs opens the door for micro-credentialing to change the scene for education. A traditional college degree no longer equates to job security or a guaranteed career (Brown et al., 2021).

The communication of academic achievements, in traditional forms such as transcripts, lacks clarity on what was actually learned and tends to emphasize disciplinary knowledge rather than skills. Although learning outcomes of degrees are often posted, they are not linked with academic transcripts for students. Additionally, student assessments from specific courses are rarely available at a degree level (Flynn, 2004; Boud, 2017). Even if available, transcripts typically show overall course grades, not performance on specific tasks. Consequently, transcripts are often of little value in the selection of job candidates (Jorre de St Jorre, 2020). Industry, government, and educational stakeholders have become increasingly interested in micro-credentialing and the impacts that more personalized micro versions of formal learning can have on participation in lifelong learning opportunities (Gibson et al., 2016).

While universities have embraced digital tools for various purposes, including managing student data and learning resources, the methods of communicating student learning have changed very little. Few universities have taken advantage of digital tools to communicate student learning, apart from the emergence of digital micro-credentials (Kato et al., 2020). As an example, Florida International University is now offering students a Co-Curricular and Experiential Learning Transcript (FIU Division of Student Affairs, n.d.) to complement their traditional academic transcript. When looking at future workforce development and preparedness, higher education should work with employment sectors to help ensure that graduates are prepared to enter a constantly changing global workforce.

Being adaptable has become especially clear in the aftermath of the COVID-19 pandemic, where there has been a renewed interest in offering micro-credentialing and short-term learning experiences in an attempt to get people back to work with renewed skill sets (Brown et al., 2021). The demand for short-term learning options, along with their industry validation, is projected to be a means to recover from the social and economic crisis that the pandemic brought as well as encourage additional higher education initiatives (Tamoliune et al., 2023). Research has supported that the COVID-19 pandemic has highlighted a need and means to develop new workforce competencies (Dirani et al., 2020).

## THE LAND-GRANT UNIVERSITY AND LIFELONG WORKFORCE DEVELOPMENT

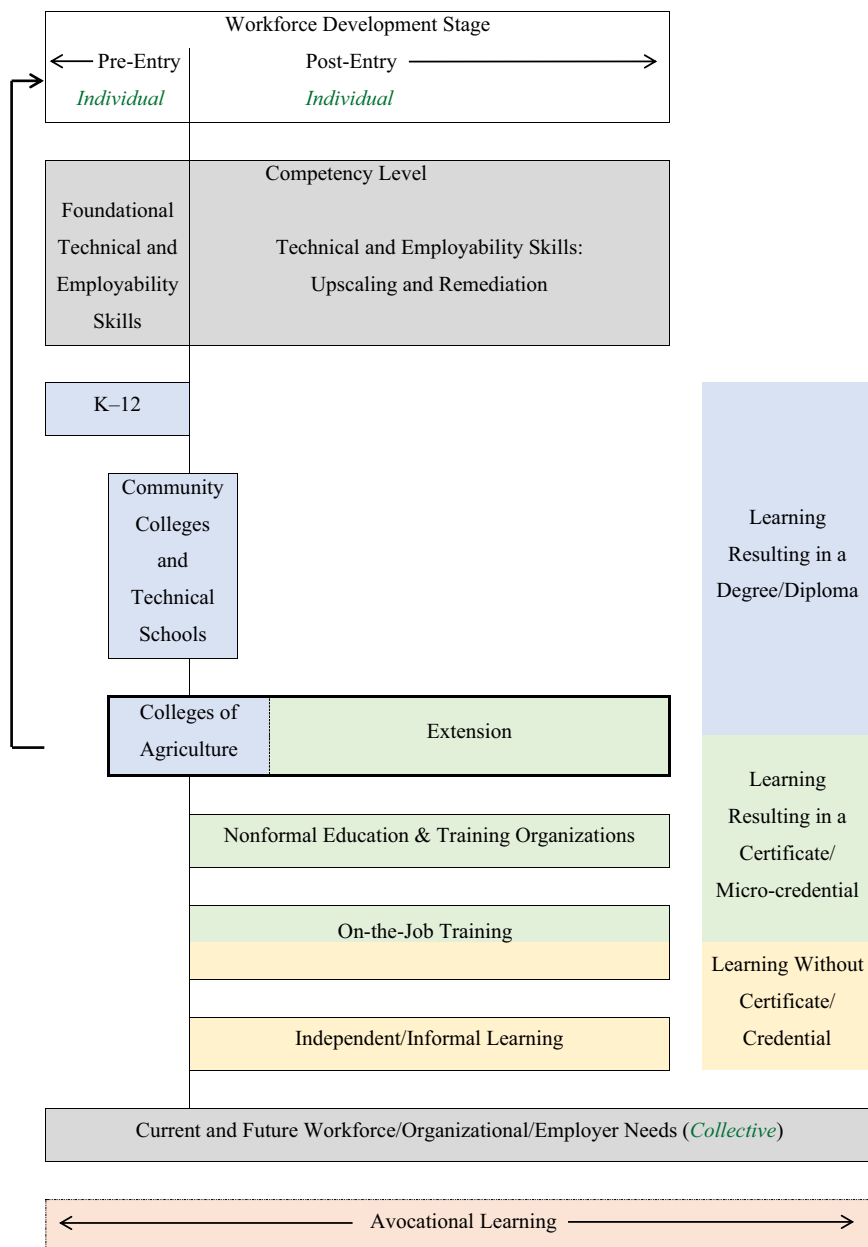
As we have described in the previous sections of this paper, the FANR workforce is rapidly changing, and formal education institutions may not be fully preparing people for lifelong career success. Continuous learning must occur after someone enters the workforce. Although Extension has a long history of providing educational programming in the

# The Land-Grant University's Role in Lifelong Workforce Development

FANR sector, we believe there is an opportunity to better link the academic and Extension programs at land-grant universities to provide seamless lifelong learning to support people throughout their careers. The novelty of our model is the *intentional* linking of academic and Extension programs.

In Figure 3, we show how people can develop the required competencies before and after entering the workforce to meet current and emerging needs within the workforce, both individually and collectively (Raelin, 1997). We also show the roles of formal, nonformal, and informal learning (Etling, 1993). Formal education institutions like K–12, community colleges, technical schools, and universities provide people with foundational technical and employability skills. We are using *employability skills* as the term to capture

the “soft skills” employers expect, like communication, problem-solving, work ethic, and so forth (Crawford & Fink, 2019). Learning from formal educational institutions typically results in awarding some kind of credential, such as a diploma or degree. Nonformal education involves organized educational opportunities delivered by various organizations, institutions, and workplace training (Etling, 1993). Nonformal education provides the opportunity to upscale or remediate employability and technical skills. Extension is one provider, perhaps the premier provider, of nonformal education. People are often awarded some kind of certificate or micro-credential as a result of nonformal education. Informal learning consists of the day-to-day learning that people gain through their daily experiences



**Figure 3.** A competency-based model for lifelong workforce development in food, agriculture, and natural resources

or independent learning, such as readings or online videos (Etling, 1993). Informal learning typically does not lead to a certificate or credential. We have also acknowledged that avocational learning (learning for personal interest or a hobby) also occurs throughout a person's life.

We want to draw attention to how we show the connection between academic and Extension programs. At many land-grant universities, academic programs in agriculture and Extension programs are administered through a college or institute of agriculture. For these universities, faculty may have both academic (teaching) and Extension appointments. We believe this administrative structure is an asset that could provide the seamless linking of formal and nonformal educational institutions (i.e., academic and Extension programs) to support people before and after entering the workforce. Academic programs benefit from long-standing reputations and can issue widely recognized credentials in the form of degrees and certificates documented in transcripts. However, academic programs often lose connections to people once they enter the workforce after graduation or never establish a relationship with those who enter the workforce without a university degree. Extension has the benefit of long-standing relationships in communities, meeting the needs of people throughout their careers after entering the workforce. However, Extension programs may not result in credentials or micro-credentials that are widely recognized. We propose linking academic programs and Extension will (1) provide the ability to support learning for people throughout their careers, and (2) provide credentials micro-credentials documented on widely recognized transcripts. There is even the potential for programs that allow for stacking micro-credentials to earn degrees after entering the workforce. We acknowledge that at some land-grant universities, Extension is situated at the university level, creating a different administrative structure. We believe our model can still be applied in this situation but recognize it will require a different level of coordination across the university.

## CONCLUSIONS AND RECOMMENDATIONS

In conclusion, we believe that colleges of agriculture at land-grant universities are uniquely equipped to meet the needs of individuals and employers for lifelong workforce development by awarding recognized credentials. However, greater collaboration and coordination are needed across the academic and Extension programs to address the needs of the current and future FANR workforce. To accomplish this goal, several actions are recommended.

Colleges of agriculture should assess the existing relationships and partnerships between their academic and Extension programs. It is understood that these mission areas often have differing administrative and funding

models. All internal, external, real, and perceived barriers to seamless collaboration should be identified and mitigated. As noted previously, both entities have a shared mission—meeting the needs of the current and future workforce and society. A personal growth and development philosophy should be developed to guide people through the various educational opportunities offered through degree programs and nonformal education programs (i.e., micro-credentials, Extension programming). Such an approach should also include opportunities for individuals to engage easily and seamlessly throughout their careers. As part of this work, colleges of agriculture should make the competencies (knowledge and skills) a person should gain when completing each degree and Extension program explicit, transparent, and publicly available. This transparency allows for greater intentionality for those engaging in these programs to select activities that best meet their needs.

We do not pretend this would be an easy model to implement. To facilitate a seamless connection, academic and Extension programs must operate from shared competency frameworks, meaning that both academic courses and Extension programs must be linked to a common set of competency outcomes. These common competency frameworks can be designed to address all four quadrants of Raelin's (1997) workforce development model. This will require a level of coordination that is not likely present in most states and likely take years to realize. Mechanisms for assessing learning and documenting the successful completion of programs (competency mastery) will also need to be developed for use in both academic and Extension programs. Funding will also need to be addressed since most academic programs charge tuition, and many Extension programs are offered at no cost. Finally, university accreditation issues will need to be considered related to the curriculum delivered and the people eligible to deliver the curriculum.

Our discussion thus far has been rather theoretical and abstract because, to our knowledge, this kind of partnership between academic and Extension programs for seamless workforce development does not exist. Assuming the administrative, funding, and curricular issues we previously noted have been resolved, what might the implementation of our model look like?

For individual people, they can begin their pre-entry workforce development in secondary school and then continue through the university. Aside from receiving their diploma and degree, they would receive a transcript outlining the specific competencies they earned. After entering the workforce, they can seek out additional training through Extension to remediate gaps in their learning or upscale their skills to address changes in their field or to prepare for other jobs. This training would result in the awarding of micro-credentials, which would be added to their transcript from

# The Land-Grant University's Role in Lifelong Workforce Development

the university. Over time, their micro-credentials could be stacked together to result in another degree. This model would allow the individual person to continue to grow and develop for the span of their entire career.

Employers can use the transcripts from prospective employees, which would now be linked to the competency frameworks, as a tool for selecting people with the necessary skills to meet the requirements of a particular position. Conversely, employers can also provide feedback to academic programs about observed gaps in what students are gaining at the university and in what employers expect for entry-level positions. Beyond screening prospective employees, employers can partner with Extension to provide targeted training that addresses ongoing and emerging competency gaps among their employees to meet their continuous need for developing their workforce. Employees would benefit from both new skills and micro-credentials on their university transcript. Employers could also position themselves as learning organizations that value the ongoing development of their employees.

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