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NMSU's Agricultural Experiment Station's Contribution to New Mexico's Economy

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Background

Education

- Ph.D. Purdue University

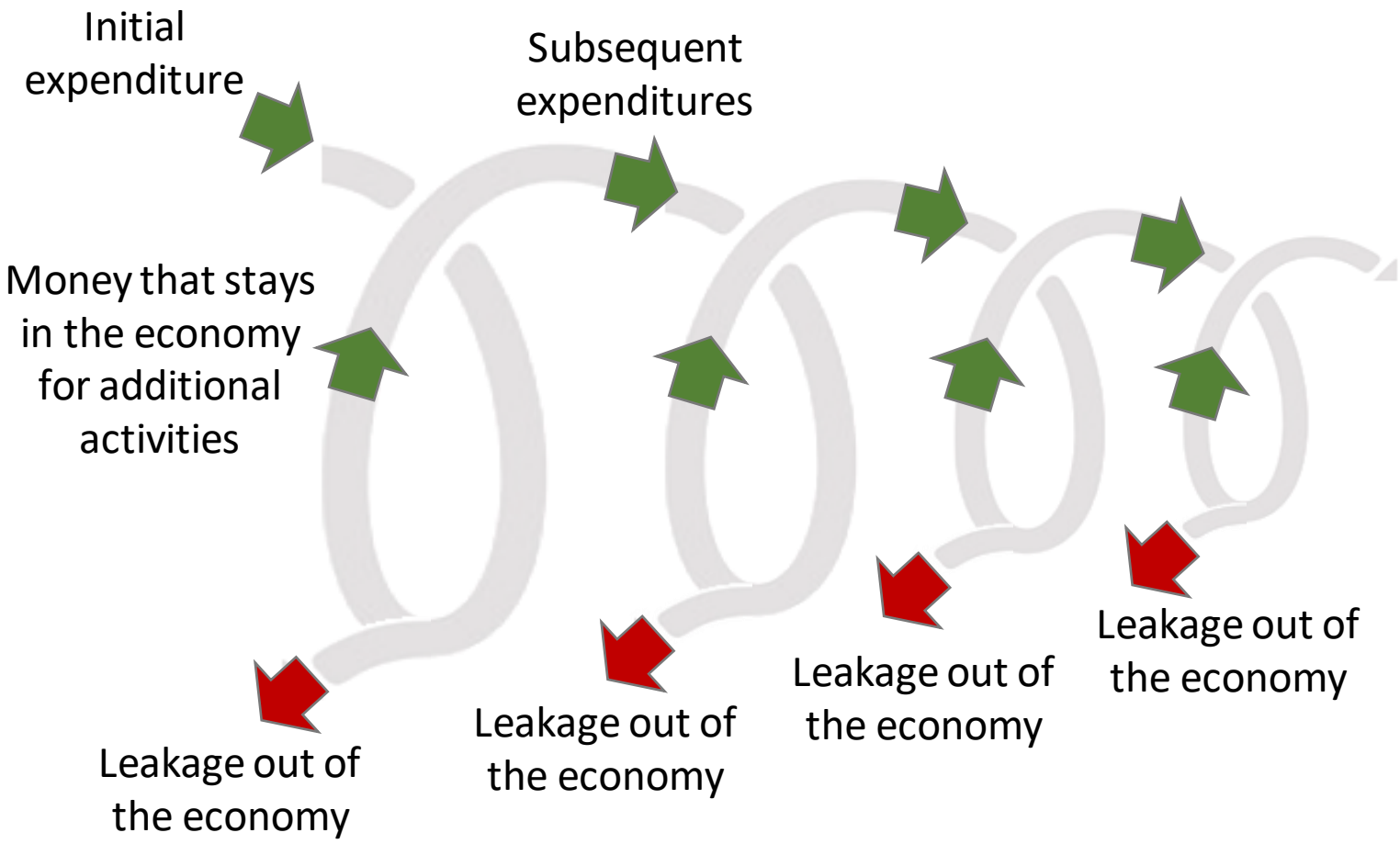
Experience

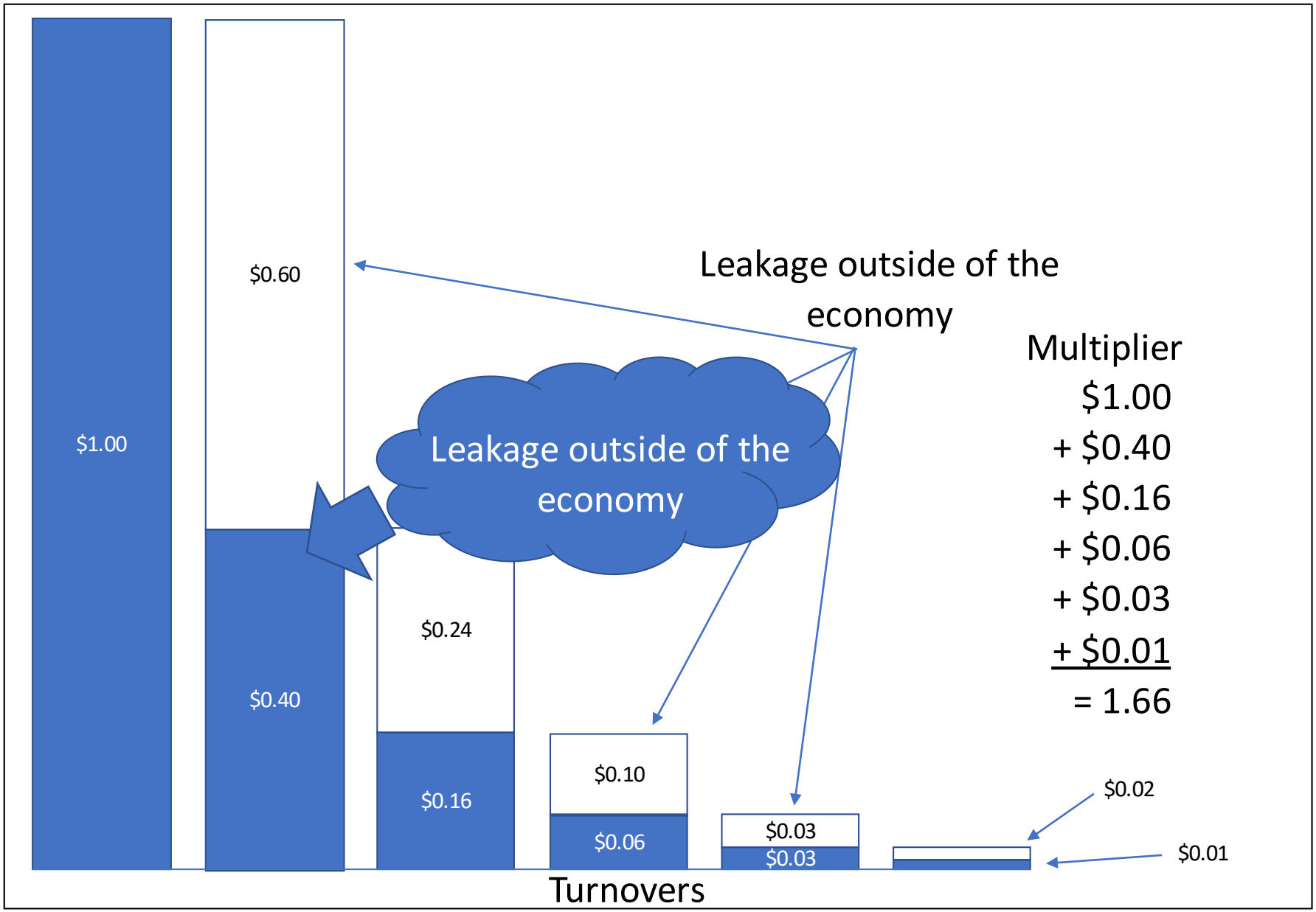
- NMSU Professor 2002-2021
- Department Head
- Co-Director

Expertise

- Consumer preferences
- Business management
- Business feasibility
- Economic impact / contribution

Money within the economy

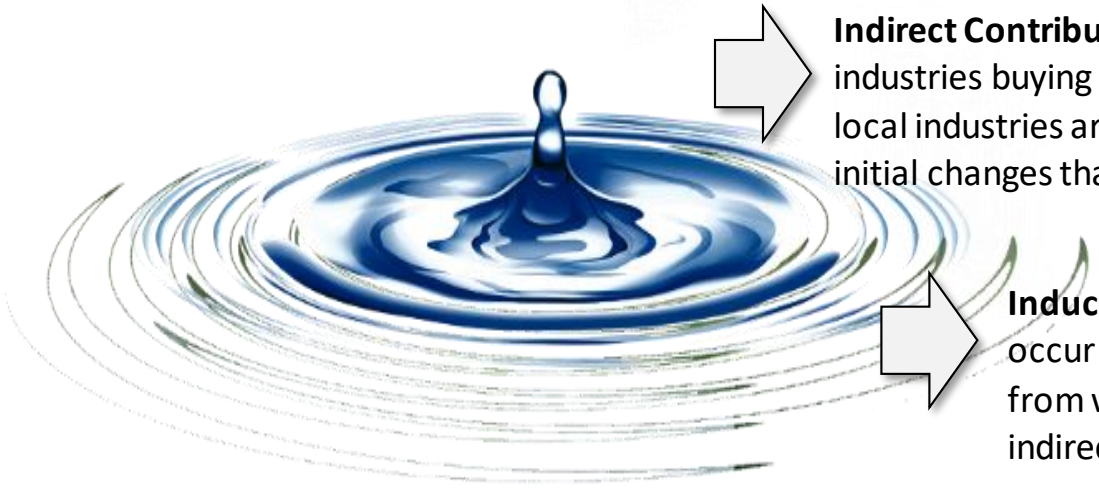



$1.00
$0.60
$0.40
$0.24
$0.16
$0.10
$0.06
$0.03
$0.03
$0.02
$0.01
Leakage outside of the economy
Leakage outside of the economy
Multiplier
$1.00
+ $0.40
+ $0.16
+ $0.06
+ $0.03
+ $0.01
= 1.66
Turnovers

Defining contributions with input-output

Input-output analysis is a method that uses industry relationships within an economy to capture total monetary transactions (output) associated with an initial change within one industry (Demski, 2020).

Direct Contribution. Initial changes that result from economic activity.



Indirect Contribution. Contributions from local industries buying goods and services from other local industries are a result of the direct contribution initial changes that result from economic activity.

Induced Contribution. Contributions that occur from spending of income received from wage earners as a result of direct and indirect contributions.

Methodology Assumptions

- *Backward linkages*. Only backward linkages and the impacts on industry segments before the industry that experienced changes ("upstream participants") are measured;
- *Constant returns to scale*. Input requirements remain constant per unit of output, regardless of how much output is generated, i.e., a ten percent increase in output requires a ten percent increase in inputs;
- *No supply constraints*. There are unlimited amounts of inputs available for production;
- *Fixed input structure*. Substitutions in inputs in response to changes in output are not allowed;
- *Industry technology assumption*. An industry uses the same technology to produce each of the products within the industry;
- *Constant make matrix*. Industries increase outputs proportionately, i.e., one output produced within the industry will not increase without a proportionate increase in other outputs within the same industry; and
- *Time is static*. Changes in input mixes, i.e., adoption of technologies over time that would change input uses, are not reflected in the methodology.

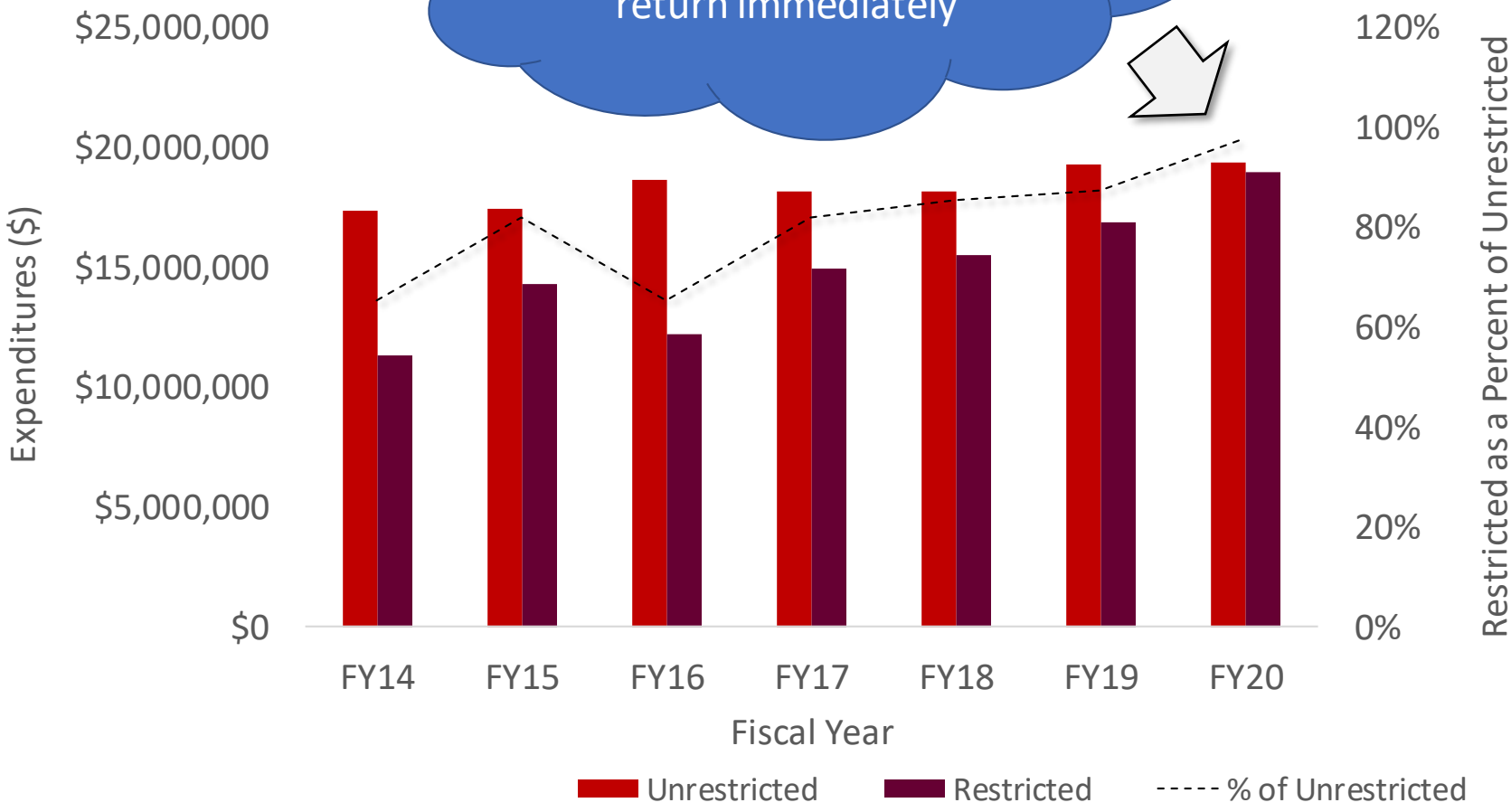
Sources of AES contribution

AES Contribution from two sources

- **Expenditures** made by the system from funding provided by the state, federal government and other sources, e.g., private businesses.
- **Increased productivity** associated with research

AES funding

From a state investment point of view, the state is getting almost a 100% return immediately



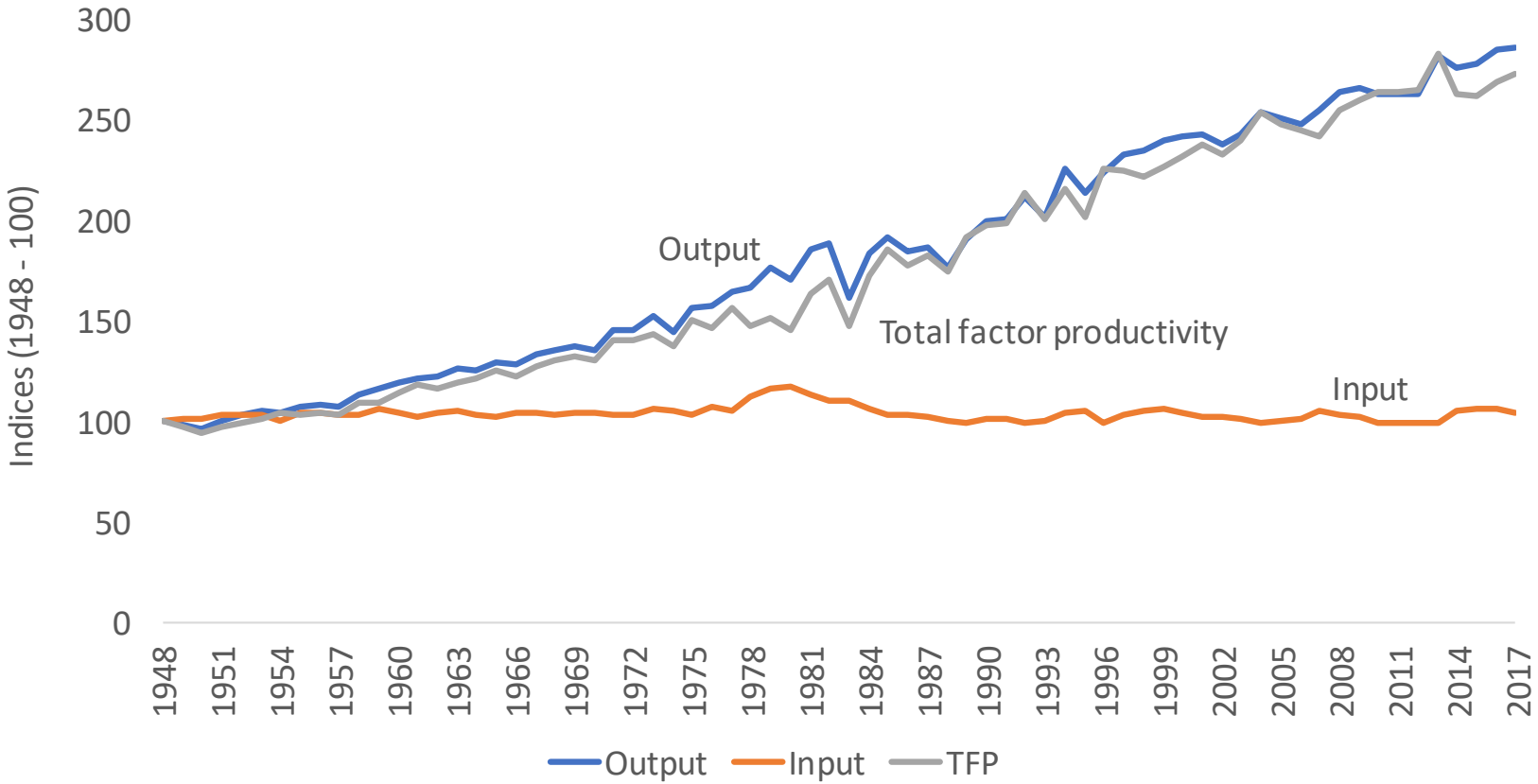
Expenditure contribution

Economic Contributions from AES System - Research Expenditures

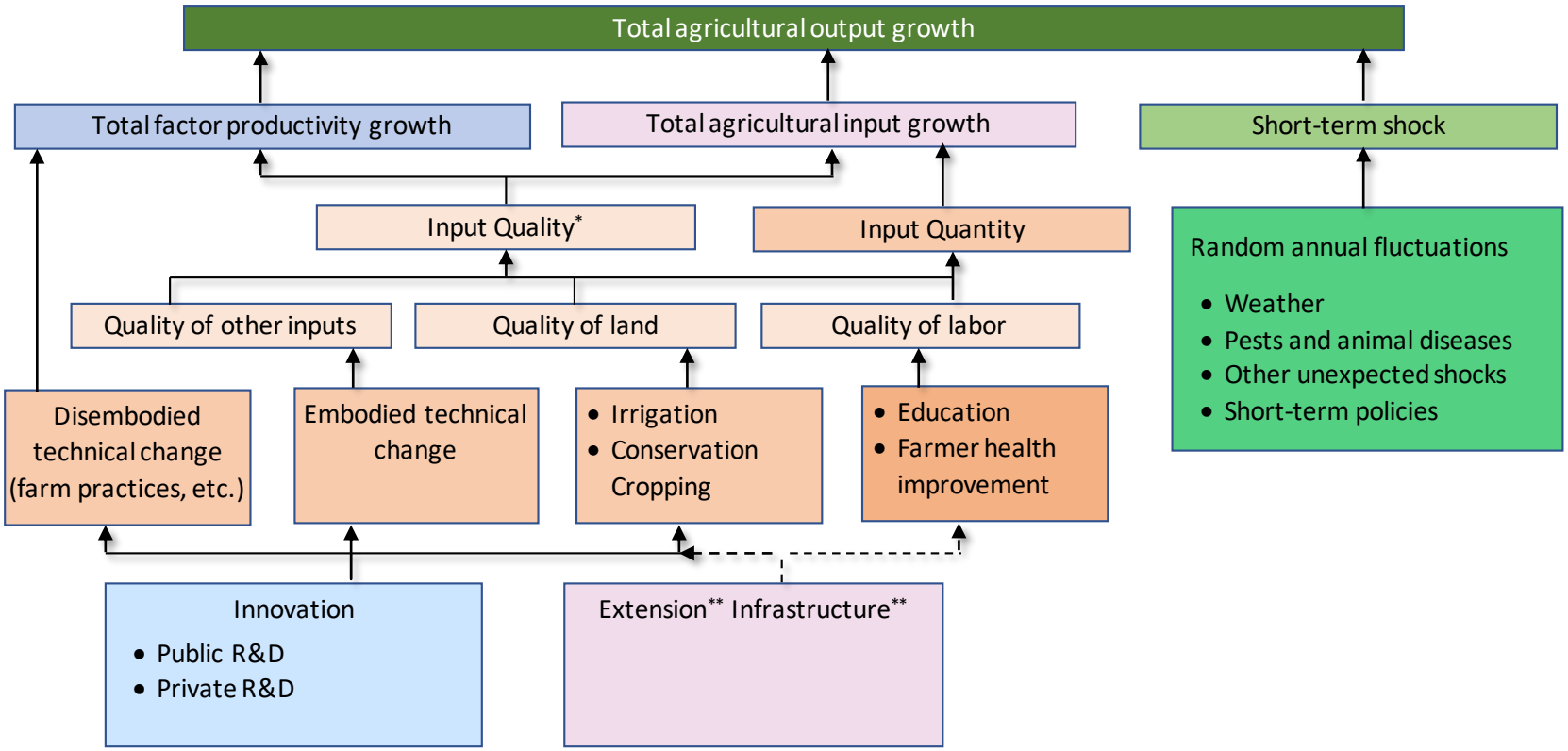
Contribution	Employment	Value Added	Output
Direct	365	$29,624,633	$38,270,410
Indirect	39	$3,307,917	$7,472,796
Induced	123	$10,032,624	$17,996,380
Total	526	$42,965,174	$63,739,586

$$\frac{\$63,739,586}{\$38,270,410} = 1.67$$

Agricultural productivity



Sources of agricultural growth



* Direction of input quality depends on how TFP and input are defined and measured.

** These activities may enhance knowledge dissemination to improve input quality and farmers' operational skills.

Returns to agricultural research

Estimated Returns to Agricultural Research in the Literature

Authors / Researchers	Social IRR	Approximated BC Ratio	Period	R&D Time Path
Baldos et al. (2015)	17%	14.29	1949-2011	50 years
Anderson and Song (2013)	21%	17.65	1949-2002	50 years
Alston et al. (2010)	23%	19.33	1949-2004	50 years
Wang et al. (2012)	45%	37.82	1980-2004	35 years
Jin and Huffman (2016)	67%	56.30	1970-2004	35 years
Huffman and Evenson (2006)	56%	47.06	1970-1999	35 years

Estimating contribution from productivity

- Use difference between New Mexico's agricultural average productivity growth rate (2.25%) and average input use rate (0.80%) to estimate growth attributable to productivity increases.
- Assume difference (2.25% - 0.80%) multiplied by annual agricultural output ($3.18 billion in 2019) is dollar amount of output related to productivity increases.
- $46.5 million of annual output associated with increased productivity – direct contribution to economy's output.

Background

Approximated Economic Contributions from AES System – Increased Productivity

Contribution	Employment	Value Added	Output
Direct	499	$20,798,818	$46,528,772
Indirect	79	$7,272,060	$14,721,928
Induced	87	$6,637,826	$12,120,107
Total	665	$34,708,704	$73,370,808

$$\frac{\$73,370,808}{\$46,528,772} = 1.58$$

Productivity examples – apples/jujube fruit

- Apples have historically played an important role in some regions of New Mexico
- Changing climate patterns have resulted in reduced and more volatile apple yields
- Researchers are exploring opportunities to supplement apple production with other fruits, e.g., jujube fruit which may be better suited for New Mexico's climate

Productivity examples – pecan genetics

- New Mexico is a world leader in pecan production ($165 million/45,000 acres in 2019)
- Pecans are heavy water users requiring between 3.3 and 4.3 acre-feet of water
- Researchers are exploring pecan genetics to better understand how tree breeding could impact productivity and input use
- **If research could reduce** pecan water used by one acre-foot the savings could reach $2.4 million annually ($54.17/acre-foot x 45,000 acres)

Productivity examples – livestock disease

- New Mexico has 1.5 million cattle and calves in 2019
- More than 20% of beef cattle placed in feedlots experience Bovine Respiratory Disease (BRD)
- Antibiotics used to treat BRD cost more than $20/animal
- At a national level BRD costs more than $600 million per year
- Research are exploring alternative (nutritional) strategies to manage BRD that would allow decreased antibiotic use and increased immunity

Additional considerations

"Not everything that can be counted counts and not everything that counts can be counted"

Albert Einstein

Contributions that are difficult to quantify

- Faculty and staff community interaction/service
- Productivity increases inside the food and fiber supply chain but not within production agriculture
- Spillover benefits to other industries, e.g., human health
- Spillover benefits to students participating in experiential learning

Conclusion

"… the world as a whole and individual nations have benefited enormously from productivity growth in agriculture, a substantial amount of which has been enabled by technological change resulting from public and private investments in agricultural R&D. *The evidence suggests that the benefits have been worth many times more than the costs*. This is still so, even if we discount the estimates heavily because we suspect they may have been upwardly biased, perhaps inadvertently through unfortunate choices of methods or limitations of the available data …".

Alston, J.M. 2010

Thank you

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