



Background on Need for Engineering Expansion

There is significant growth & demand for STEM graduates in the U.S.

- o Studies have shown that 50-85% of GDP growth in U.S. is due to advances in science & engineering*

State of Kansas funded an Engineering initiative in 2011

- o KU, K-State, & WSU were each funded by \$3.5 million per year to increase the number of Engineering graduates
- o Goal is to increase from 875 grads to 1367 in ten years; that is, an **increase of 164 grads by each school**

*Reference: Norm Augustine, *U.S. News & World Report*, 8 June 2012

Background on Current State of Engineering Expansion

	255	335	338	367	400	499	435	526	419
		+80	+83	+112	+145	+244	+180	+271	+164
WSU	197	214	208	238	267	292	304	345	361
	(0)	+17	+11	+41	+70	+95	+107	+148	+164

This table shows progress made so far by the three universities in Kansas with Engineering expansion*

- o Engineering _____ are in black and **increase in red**
- o **Baseline from 2008** and **goal in 2021** after 10 years of expansion

Background on Current State of Engineering Expansion

									526	419
									+271	+164
WSU	197	214	208	238	267	292	304	345	361	361
	(0)	+17	+11	+41	+70	+95	+107	+148	+148	+164

KU reached its goal in 2016

K-State reached its goal in 2017

WSU has been making steady progress over the past 7 years and has achieved a 75% increase over their baseline

Motivation / Methodology

Motivation: are there other important metrics besides raw number of Engineering graduates?

- o What is the _____ impact for the State?
 - o Are universities in Kansas meeting the _____ for discipline specific types of Engineers?
-

Methodology:

- 1) Determine economic impact from the number of Engineering graduates employed in Kansas and their entry-level wages
- 2) Estimate future labor demand for discipline-specific areas of Engineering

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Information Available about Engineering Graduates Employed in Kansas

						230	288
KU	133	122	115	156	180	147	176
WSU	149	131	145	154	162	165	184

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Percentage of Engineering Graduates Employed in Kansas

School	2012	2013	2014	2015	2016	2017	2018	7-yr Ave
K-State	45.6%	41.0%	42.5%	44.4%	41.1%	37.8%	41.5%	42.0%
KU	39.7%	36.1%	31.3%	39.0%	36.1%	33.8%	33.5%	35.6%
WSU	69.6%	63.0%	60.9%	57.7%	55.5%	54.3%	53.3%	59.2%
Wt Ave	48.7%	43.9%	42.8%	45.6%	42.4%	40.2%	41.4%	43.6%

Table provides the percentage of Engineering graduates employed in Kansas from each university

- o Last row has _____ (total employ in KS / total grads)
- o Last column has the _____ average
- o Wt average over 7-years of _____ will be used in later estimate

Percentage of Engineering Graduates Employed in Kansas

School	2012	2013	2014	2015	2016	2017	2018	7-yr Ave
K-State	45.6%	41.0%	42.5%	44.4%	41.1%	37.8%	41.5%	42.0%
KU	39.7%	36.1%	31.3%	39.0%	36.1%	33.8%	33.5%	35.6%
WSU	69.6%	63.0%	60.9%	57.7%	55.5%	54.3%	53.3%	59.2%
Wt Ave	48.7%	43.9%	42.8%	45.6%	42.4%	40.2%	41.4%	43.6%

On average, percentage employed in KS: K-State = 42.0%, KU ~ 35.6%, and WSU ~ 59.2%

- o Higher proportion of WSU grads work in KS compared to others
- o Purpose of state's funding is to increase number of Engr grads staying & working in KS rather than exporting majority out of state
- o WSU provides better "bang for the buck" to the state

Returning to the First Question

What is the economic impact of the Engineering initiative for the State?

Determining Total Wages Earned by Engineering Grad Employed in Kansas

Recall earlier data on Engr grads employed in KS & their **wages**

School	2012	2013	2014	2015	2016	2017	2018
K-State	<u>219</u> \$48,314	<u>193</u> \$48,065	<u>225</u> \$51,545	<u>221</u> \$55,310	<u>203</u> \$50,563	<u>230</u> \$49,879	<u>288</u> \$53,122
KU	<u>133</u> \$45,883	<u>122</u> \$46,510	<u>115</u> \$50,548	<u>156</u> \$47,741	<u>180</u> \$46,603	<u>147</u> \$46,951	<u>176</u> \$49,082
WSU	<u>149</u> \$44,216	<u>131</u> \$45,334	<u>145</u> \$44,623	<u>154</u> \$49,043	<u>162</u> \$49,307	<u>165</u> \$45,053	<u>184</u> \$49,353

Total wages earned by Engr grads employed in KS is determined by multiplying the number of grads (top line) & their **wages** (bottom line)

Year	2012	2013	2014	2015	2016	2017	2018
Total wages (millions)	\$23.27	\$20.89	\$23.88	\$27.22	\$26.64	\$25.81	\$33.02

Estimate of Economic Impact of Engineering Initiative to Kansas

Compounding effect assuming that the 2012 grads earn the same salary in 2013, 14, etc. up through 2018

- o Similarly for other years, then add up to get compound result

						2018	
\$2.27	\$5.26	\$8.60	\$8.02	\$7.18	\$14.40	\$159.67	

Above is for direct wages earned by additional Engr grads in KS

Economic analysis* made when Engr initiative was proposed found that for each \$1 in Engr wages, support staff is paid \$1.0903 in wages

- o Result of additional Engr & additional support staff is the following:

Second Question

What is the future labor demand for discipline-specific areas of Engineering?

Labor Demand Estimate: Step 1a – Discipline Specific Graduates

Table gives total number of grads in seven high-demand majors

Major (School)	2014	2015	2016	2017	2018	5-yr Ave	S.D.
Aerospace (KU & WSU)	82	87	89	68	74	80	8 (10%)
Civil (K-State & KU)	110	109	113	100	114	109	5 (5%)
Computer Engr (all three)	58	53	55	70	64	60	6 (10%)
Computer Sc (all three)	83	99	136	191	219	146	52 (36%)
Electrical (all three)	118	104	135	126	109	119	11 (10%)
Industrial (K-State & WSU)	65	70	62	78	96	74	12 (16%)
Mechanical (all three)	311	340	353	326	422	348	39 (11%)

5-yr average and **standard deviation (S.D.)** are also given

Most majors have a lot of variability as indicated by the **large S.D.**

Step 1b – Estimating Discipline Specific Employment in Kansas

School	Aerospace	Civil	Comp En	Comp Sc	Electrical	Industrial	Mechanical
5-yr Ave	80	109			119	74	348
KS	35	48			52	32	152

Difficult to gauge how many computer-related occupations need to be filled by Bachelor's Computer Engr & Sc grads

Thus, Kansas labor demand analysis in this presentation will focus on Aerospace, Civil, Electrical, Industrial, and Mechanical Engineers

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Step 2 – Employment & Estimated Labor Demand by Major

Category	Aerospace	Civil	Electrical	Industrial	Mechanical
U.S. employment	69,600	303,500	324,600	257,900	288,800
KS employment	2200	2340	1960	2920	2710
10-yr U.S. growth	6%	11%	7%	10%	9%

To determine annual KS growth, U.S. employment number (top table 1st row) is multiplied by 1/10th of the annual growth rate (top table last row) and by the KS-to-US employment ratio (bottom table top row)

 is given in the second row of the table below

Category	Aerospace	Civil	Electrical	Industrial	Mechanical
KS/U.S. employ	3.2%	0.8%	0.6%	1.1%	0.9%
Annual KS growth	13	25	13	28	24

Step 2 – Employment & Estimated Labor Demand by Major

					257,900	288,800
KS employment	2200	2340	1960	2920	2710	
10-yr U.S. growth	6%	11%	7%	10%	9%	

Estimated Labor Demand by Major

Category	Aerospace	Civil	Electrical	Industrial	Mechanical
Annual KS growth	13	25	13	28	24
Annual KS replace	110	117	98	146	136
Sum of above	123	142	111	174	160
KDOL estimate*	135	198	188	172	207

Adding the annual KS growth and the annual KS replacement numbers (i.e., sum of 1st & 2nd rows)

Results in the estimated KS labor demand (3rd row)

Kansas Department of Labor (KDOL) estimates (shown in last row) are generally slightly larger demand for these majors

- o Our estimates are generally conservative

*Reference: Kansas Board of Regents (based on KDOL data), *Foresight 2020*

Labor Demand vs. Graduates by Major

Category	Aerospace	Civil	Electrical	Industrial	Mechanical
Current study	123	142	111	174	160
KDOL estimate	135	198	188	172	207

Table above is previously found labor demand (current study & KDOL) KBOR reported 2018 total number of graduates by major, including M.S. & Ph.D. (top row) while bachelor's grads (2nd row) is less than that

Category	Aerospace	Civil	Electrical	Industrial	Mechanical
2018 total grads*	103	176	159	184	483
2018 B.S. grads	74	114	109	96	422

*Reference: Kansas Board of Regents (based on KDOL data), *Foresight 2020*

135

198

188

172

207

Conclusions

State of Kansas began an Engineering initiative in 2011

- o KU reached its goal early in 2016
- o K-State has graduated a large number of Engr grads
- o WSU provides highest percentage of its Engr grads working in KS

\$159.67 million (compound total) of wages from additional Engr in KS due to Engr Initiative vs. \$73.5 million invested by State in 7 yrs

When staff hired to support these additional Engr's are included, compound total is \$333.75 million

Graduation numbers for specific disciplines in Engineering were determined

Future labor demand for Aerospace, Civil, & Electrical Engineers as well as Computer-related fields exceed graduation numbers in Kansas