Financial Support

Potential Sub-Sectors and Factors for Diversification in Agriculture and Agro-Processing Industry in Cambodia

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Future Forum, September 22, 2020

Outline

❶ This Paper

❷ Model

❸ Data

❹ Some Results

This Paper

- ▶ What I Do
  - Explore to identify key factors or sub-sectors in agriculture and agro-processing that the Agricultural and Rural Development Bank should focus on providing financial support.

- ▶ Main Research Question
  - What are the sub-sectors and factors in agriculture and agro-processing industry that the Agricultural and Rural Development Bank should support financially?

This Paper

▶ Sub-Research Question:

1. Why is the diversification of agricultural products essential in the Cambodian context?

2. What products of the agriculture and agro-processing industry have the potential to develop?

3. What are the essential factors to stimulate production in the agriculture and agro-processing industry sectors?

4. What are the critical factors in the agriculture and agro-processing industry that require financial support?

5. What types of policies are necessary for the Agricultural and Rural Development Bank to respond to sustainable development in agriculture and agro-processing industry?

The Challenge of the I/O Model

▶ Before the Leontief analysis, we need to have the IOT or the SUT.

  ■ In this model, we assume that *input* or *comsumpution* (C) = *output* or *production* (P).

$$C = P \tag{1}$$

  ■ Thus, when we know the $ValueAdded$ (GVA_{MP}), $ValueOutput$ of each product, we will know the $IntermediateConsumption$ (IC).

$$GVA_{MP} = P - IC \tag{2}$$

  ■ When we do not know P, it equals to:

$$P = NVA_{FC} + FV + NIT \tag{3}$$

The Challenge of the I/O Model

- NIT

$$NIT = GST - Subsidy \qquad (4)$$

$$GVA_{MP} = NVA_{FC} + FV + (GST - Subsidy) \qquad (5)$$

Were NVA_{FC} = Net value added at factor cost, FV = Depreciation, NIT = Negative income tax, GST = Goods and services tax

- Or Total output of each product:

$$Output = IC + HFCE + NPISH + GFCE + GFCF + CI + X \quad (6)$$

Where $HFCE$ = Households final consumption expenditure, $NPISH$ = Non-profit organisations serving household, $GFCE$ = General government final consumption expenditure, $CFCF$ = Gross fixed capital formation, CI = Changes in inventories, X = Export

The Challenge of the I/O Model

▶ Some advice from I/O experts:

- Antonio F. Amores and Jose M. Rueda-Cantuche:
  - Building a supply-use or input-output framework is a highly complex major statistical operation that requires lots of expertise to reconcile are data sources.
  - They suggest using the Cambodian table embedded in any multiregional input-output database (i.e. GTAP, ASEAN and EORA). Is better than what anyone can build with very limited data, resources and expertise.

- Jan Oosterhaven:
  - To build an IOT or SUT from the meager data you indicate is very difficult.
  - Most importantly imports and exports. No data on (IC) you need to select a group of countries is economically similar to Cambodia and use the CRAS method. It's like Mike, Bong Theara and Bong Keo Chettra (NIS) adivced.

The Challenge of the I/O Model

- Keo Chettra:
  - There are no words to get enough data in the analysis, but the question is how to use the data we have in the analysis.
  - It requires extensive knowledge in mathematics and statistics (econometrics).
  - Diversification: Should focus on market.
- ▶ But, we can not access *IC* data of each products in the agricultural sector.
  - In Cambodia, we have the IOT by ADB between 2010-2017 with 35 sectors. Oum Sothea, the IOT in 2003 with 20 sectors (8 agricultural sectors).
- ▶ I am now waiting for the NIS and MAFF data.

New Model: Power Market

▶ **Market Participants and Shares**: The Herfindahl-Hirschman Index (HHI) is a common measure of market concentration and is used to determine market competitiveness, often pre- and post-Mergers and Acquisitions (M&A) transactions.

$$HHI = \sum_{i=1}^{N} s_i^2; HHI^* = \frac{(HHI - 1/N)}{1 - 1/N}; i = 1, ..., n \qquad (7)$$

$$s_i = \frac{AR_i}{D}100; N > 1 \qquad (8)$$

Wher N = Number of market participants; s_i = Market share of participan i, D = Total system demand, AR_i = Resource allocated to participant i.

New Model: Power Market

- An HHI below 0.01 (or 100) indicates a highly competitive industry.
- An HHI below 0.15 (or 1,500) indicates an unconcentrated industry.
- An HHI between 0.15 to 0.25 (or 1,500 to 2,500) indicates moderate concentration.
- An H above 0.25 (above 2,500) indicates high concentration.

▶ The corresponding disadvantage is that concentration is about relative revenue and thus includes no information about costs or profits.

New Model: Price Estimation

▶ I will use the ARIMA model (Autoregressive integrated moving average) model for price forecasting in agriculture. Many statistical studies have suggested that the model is the most accurate of individual forecasting techniques.

$$\left(1 - \sum_{i=1}^{p'} \alpha_i L^i\right) X_t = \left(1 + \sum_{i=1}^{q} \theta_i L^i\right) \varepsilon_t \tag{9}$$

Where L is the lag operator, the α_i are the parameters, of the autoregressive part of the model, the θ_i are the parameters of the moving average part and the ε_t are error terms.

▶ Data: I will use the MAFF agricultural price (Monthly Market Report) in 2007-2020.

New Model: Potential Products based on Input

▶ I will use the Fixed effect model or OLS model, or GMM model (Generalized method of moments) to understand relationship between input and output.

▶ Data: Production output, Agricultural land, Producer prices, FDI in agriculture, Credit to agriculture, Subsidy to agriculture, Labour costs, Labour participation, Pesticide use, Fertilizer use, Agricultural tractors, Temperature change.

Data

Table 1: Descriptive Statistics of Gross Agricultural Production in 1959-2018 in Million USD

Code	Commodity	1959-1988				1989-2018				1959-2018			
		Min	Mean	Max	St. Dev.	Min	Mean	Max	St. Dev.	Min	Mean	Max	St. Dev.
C01	Bananas	11.95	22.80	34.77	6.08	24.34	29.88	34.55	2.38	11.95	26.34	34.77	5.82
C02	Cassava	3.30	11.88	66.19	13.72	12.76	770.63	2926.18	991.71	3.30	391.25	2926.18	797.35
C03	Castor oil seed	0.01	0.13	0.44	0.14	0.15	0.17	0.18	0.01	0.01	0.15	0.44	0.10
C04	Coconuts	4.79	11.72	16.31	2.79	15.31	20.72	25.83	3.01	4.79	16.22	25.83	5.36
C05	Cotton lint	0.04	2.14	11.71	3.36	0.11	0.11	0.13	0.01	0.04	1.13	11.71	2.58
C06	Cottonseed	0.01	0.38	2.09	0.60	0.01	0.02	0.02	0.00	0.01	0.20	2.09	0.46
C07	Dry beans	5.80	11.69	19.83	2.96	5.31	23.82	50.14	15.99	5.31	17.76	50.14	13.00
C08	Dry chillies and peppers	1.85	2.83	3.60	0.46	3.42	4.72	5.92	0.72	1.85	3.78	5.92	1.12
C09	Fibre crops nes	0.18	0.63	1.37	0.41	0.25	0.41	0.52	0.09	0.18	0.52	1.37	0.32
C10	Fresh nes fruit	3.67	8.78	14.70	3.56	15.07	22.52	27.93	4.41	3.67	15.65	27.93	7.95
C11	Fresh nes vegetables	120.51	161.75	183.22	17.85	171.77	191.73	239.71	16.56	120.51	176.74	239.71	22.83
C12	Grapefruit and pomelos	0.26	0.94	2.78	0.74	0.48	0.63	0.72	0.07	0.26	0.78	2.78	0.54
C13	Green coffee	0.02	0.87	2.31	0.69	0.58	1.12	1.43	0.27	0.02	0.99	2.31	0.54
C14	Groundnuts with shell	0.60	8.12	18.33	5.22	2.14	11.66	21.62	7.07	0.60	9.89	21.62	6.46
C15	Jute	0.02	0.31	0.95	0.23	0.02	0.08	0.24	0.07	0.02	0.19	0.95	0.21
C16	Lemons and limes	0.09	0.49	1.50	0.48	0.25	0.48	0.64	0.12	0.09	0.48	1.50	0.35
C17	Maize	5.17	14.60	33.48	7.68	5.78	43.79	129.49	39.45	5.17	29.20	129.49	31.95
C18	Mangoes, mangosteens and guavas	1.56	6.13	12.77	3.43	4.67	9.86	15.67	3.48	1.56	7.99	15.67	3.93
C19	Natural rubber	1.15	5.97	12.22	3.53	3.28	6.86	10.42	2.14	1.15	6.41	12.22	2.95
C20	Nuts nes	0.07	0.17	0.23	0.05	0.15	0.30	0.40	0.08	0.07	0.24	0.40	0.10
C21	Oilseeds nes	1.28	4.22	8.55	2.39	0.43	1.14	3.42	1.04	0.43	2.68	8.55	2.40
C22	Oranges	22.56	37.54	50.75	7.49	47.37	67.26	73.59	8.75	22.56	52.40	73.59	16.95
C23	Paddy rice	74.74	279.89	529.88	110.94	308.56	798.72	1535.96	396.98	74.74	539.31	1535.96	390.19
C24	Pepper and piper spp	1.23	2.30	4.44	0.65	2.64	3.93	4.52	0.55	1.23	3.12	4.52	1.01
C25	Pineapples	1.52	4.07	9.98	2.12	3.35	5.61	7.75	1.35	1.52	4.84	9.98	1.94

Data

Code	Commodity	1959-1988				1989-2018				1959-2018			
		Min	Mean	Max	St. Dev.	Min	Mean	Max	St. Dev.	Min	Mean	Max	St. Dev.
C26	Roots and tubers nes	0.62	0.91	1.86	0.36	2.02	4.29	6.51	1.34	0.62	2.60	6.51	1.95
C27	Seed cotton	0.04	2.12	11.59	3.32	0.10	0.11	0.22	0.02	0.04	1.12	11.59	2.55
C28	Sesame seed	0.83	5.17	10.15	2.43	3.14	17.97	74.41	15.17	0.83	11.57	74.41	12.61
C29	Soybeans	0.32	1.90	4.18	1.14	5.55	27.95	57.63	18.42	0.32	14.93	57.63	18.44
C30	Sugar cane	52.87	316.17	693.89	145.89	156.18	404.02	853.12	241.26	52.87	360.09	853.12	204.14
C31	Sweet potatoes	1.48	3.24	9.05	1.77	2.90	4.82	9.20	1.46	1.48	4.03	9.20	1.80
C32	Unmanufactured tobacco	6.13	14.16	31.59	5.79	4.80	20.84	33.73	7.45	4.80	17.50	33.73	7.46
L01	Buffalo meat	1.15	16.80	30.70	11.43	24.91	32.28	38.84	4.05	1.15	24.54	38.84	11.55
L02	Buffalo meat indigenous	4.28	19.59	31.39	8.74	28.85	33.26	38.84	2.95	4.28	26.42	38.84	9.44
L03	Cattle meat	8.39	16.42	25.82	4.67	29.10	55.05	70.65	12.98	8.39	35.73	70.65	21.63
L04	Cattle meat indigenous	8.39	16.63	25.84	5.16	29.10	56.55	70.65	13.92	8.39	36.59	70.65	22.55
L05	Chicken meat	7.82	18.49	42.72	7.76	37.65	54.05	70.39	6.97	7.82	36.27	70.39	19.25
L06	Chicken meat indigenous	7.82	18.49	42.72	7.76	37.65	53.61	70.39	6.75	7.82	36.05	70.39	19.01
L07	Duck meat	0.91	4.02	7.42	1.68	7.54	13.92	18.41	3.85	0.91	8.97	18.41	5.77
L08	Duck meat indigenous	0.91	4.02	7.42	1.68	7.54	13.80	17.68	3.72	0.91	8.91	17.68	5.68
L09	Hen eggs in shell	3.33	5.37	7.87	1.28	8.48	13.49	20.19	3.29	3.33	9.43	20.19	4.76
L10	Other bird eggs in shell	0.55	2.31	3.15	0.83	3.18	4.35	5.31	0.68	0.55	3.33	5.31	1.27
L11	Pig meat	13.05	65.39	149.09	37.67	150.58	253.88	344.16	46.66	13.05	159.63	344.16	103.34
L12	Pig meat indigenous	13.05	67.71	149.09	35.33	150.58	235.71	341.69	45.44	13.05	151.71	341.69	93.34
L13	Silkworm coiling cocoons	0.14	0.29	0.34	0.07	0.21	0.33	0.47	0.08	0.14	0.31	0.47	0.08
L14	Whole fresh cow milk	0.59	0.86	1.10	0.13	0.91	8.74	10.75	2.26	0.59	4.80	10.75	4.25

Note: The table presents the descriptive statistics of Gross Agricultural Production of each commodity in Cambodia between 1959 to 2018 at a price constant in 2004-2006 in million USD. The author use data from FAOSTAT with 46 agricultural products between 1961-2018. The author used linear interpolation and multiplicative cubic spline interpolation to estimate the gross agricultural production value between 1959-1960 and some missing data based on FAOSTAT data.

Some Results

Table 2: Cambodian Agricultural Market Participation Between 1959-2018

Code	Commodity	1959-1973	1974-1988	1989-2003	2004-2018	1959-2018
C01	Bananas	0.0199	0.0178	0.0155	0.0064	0.0116
C02	Cassava	0.0038	0.0180	0.0151	0.3171	0.1729
C03	Castor oil seed	0.0001	0.0001	0.0001	0.0000	0.0001
C04	Coconuts	0.0082	0.0118	0.0099	0.0048	0.0072
C05	Cotton lint	0.0027	0.0005	0.0001	0.0000	0.0005
C06	Cottonseed	0.0005	0.0001	0.0000	0.0000	0.0001
C07	Dry beans	0.0096	0.0100	0.0050	0.0080	0.0078
C08	Dry chillies and peppers	0.0021	0.0028	0.0022	0.0011	0.0017
C09	Fibre crops nes	0.0007	0.0003	0.0002	0.0001	0.0002
C10	Fresh nes fruit	0.0045	0.0110	0.0098	0.0056	0.0069
C11	Fresh nes vegetables	0.1174	0.1578	0.0958	0.0427	0.0781
C12	Grapefruit and pomelos	0.0011	0.0004	0.0003	0.0001	0.0003
C13	Green coffee	0.0010	0.0003	0.0005	0.0003	0.0004
C14	Groundnuts with shell	0.0083	0.0047	0.0027	0.0038	0.0044
C15	Jute	0.0003	0.0002	0.0001	0.0000	0.0001
C16	Lemons and limes	0.0006	0.0001	0.0002	0.0001	0.0002
C17	Maize	0.0151	0.0083	0.0071	0.0156	0.0129
C18	Mangoes, mangosteens and guavas	0.0066	0.0031	0.0036	0.0027	0.0035
C19	Natural rubber	0.0061	0.0035	0.0045	0.0011	0.0028
C20	Nuts nes	0.0001	0.0001	0.0001	0.0001	0.0001
C21	Oilseeds nes	0.0046	0.0021	0.0009	0.0001	0.0012
C22	Oranges	0.0294	0.0337	0.0329	0.0152	0.0232
C23	Paddy rice	0.2600	0.1976	0.2409	0.2399	0.2383
C24	Pepper and piper spp	0.0020	0.0018	0.0019	0.0009	0.0014
C25	Pineapples	0.0042	0.0023	0.0023	0.0014	0.0021
C26	Roots and tubers nes	0.0005	0.0011	0.0017	0.0011	0.0011
C27	Seed cotton	0.0027	0.0005	0.0001	0.0000	0.0005
C28	Sesame seed	0.0049	0.0035	0.0033	0.0062	0.0051
C29	Soybeans	0.0016	0.0015	0.0057	0.0095	0.0066
C30	Sugar cane	0.2981	0.2173	0.1277	0.1191	0.1591
C31	Sweet potatoes	0.0019	0.0038	0.0022	0.0012	0.0018
C32	Unmanufactured tobacco	0.0125	0.0109	0.0083	0.0055	0.0077
L01	Buffalo meat	0.0075	0.0226	0.0185	0.0062	0.0108
L02	Buffalo meat indigenous	0.0116	0.0226	0.0187	0.0066	0.0117
L03	Cattle meat	0.0128	0.0148	0.0239	0.0137	0.0158
L04	Cattle meat indigenous	0.0131	0.0148	0.0241	0.0142	0.0162
L05	Chicken meat	0.0103	0.0222	0.0272	0.0119	0.0160
L06	Chicken meat indigenous	0.0103	0.0222	0.0271	0.0118	0.0159
L07	Duck meat	0.0021	0.0050	0.0056	0.0036	0.0040
L08	Duck meat indigenous	0.0021	0.0050	0.0056	0.0036	0.0039
L09	Hen eggs in shell	0.0032	0.0062	0.0058	0.0034	0.0042

Table 2 continued from previous page

Code	Commodity	1959-1973	1974-1988	1989-2003	2004-2018	1959-2018
L10	Other bird eggs in shell	0.0013	0.0028	0.0020	0.0010	0.0015
L11	Pig meat	0.0451	0.0669	0.1185	0.0598	0.0705
L12	Pig meat indigenous	0.0485	0.0669	0.1184	0.0522	0.0670
L13	Silkworm coiling cocoons	0.0003	0.0002	0.0002	0.0001	0.0001
L14	Whole fresh cow milk	0.0006	0.0008	0.0040	0.0021	0.0021
46	Total Market Participation	1.0000	1.0000	1.0000	1.0000	1.0000
	HHI	0.1775	0.1251	0.1170	0.1820	0.1301

Note: The table presents the agricultural market participation between 1959-2018. The author assumed that the total participation equated to 46 agricultural commodities; it means a hundred percent participation in the market. The full share of each agricultural product to market is equal to 1 or a hundred percent. The author used gross agricultural production value at a price constant between 2004-2006 to build the coefficient. An HHI between 0.15-0.25 (or 1,500-2,500) indicates moderate concentration. As a result of the Herfindahl-Hirschman Index, We see that 1959-1973 and 2004-2018; the agricultural sector is not much competitive industry. But between 1959-2018 and others, the agricultural sector is an unconcentrated industry because the value of HHI is below 0.15 (or 1,500).

Some Results

Table 3: Classification of the Contribution of the Agricultural Product to the Market

No	Code	Commodity	1959-1973	1974-1988	1989-2003	2004-2018	1959-2018
1	C23	Paddy rice	0.2600	0.1976	0.2409	0.2399	0.2383
2	C02	Cassava	0.0038	0.0180	0.0151	0.3171	0.1729
3	C30	Sugar cane	0.2981	0.2173	0.1277	0.1191	0.1591
4	C11	Fresh nes vegetables	0.1174	0.1578	0.0958	0.0427	0.0781
5	L11	Pig meat	0.0451	0.0669	0.1185	0.0598	0.0705
6	L12	Pig meat indigenous	0.0485	0.0669	0.1184	0.0522	0.0670
7	C22	Oranges	0.0294	0.0337	0.0329	0.0152	0.0232
8	L04	Cattle meat indigenous	0.0131	0.0148	0.0241	0.0142	0.0162
9	L05	Chicken meat	0.0103	0.0222	0.0272	0.0119	0.0160
10	L06	Chicken meat indigenous	0.0103	0.0222	0.0271	0.0118	0.0159
11	L03	Cattle meat	0.0128	0.0148	0.0239	0.0137	0.0158
12	C17	Maize	0.0151	0.0083	0.0071	0.0156	0.0129
13	L02	Buffalo meat indigenous	0.0116	0.0226	0.0187	0.0066	0.0117
14	C01	Bananas	0.0199	0.0178	0.0155	0.0064	0.0116
15	L01	Buffalo meat	0.0075	0.0226	0.0185	0.0062	0.0108
16	C07	Dry beans	0.0096	0.0100	0.0050	0.0080	0.0078
17	C32	Unmanufactured tobacco	0.0125	0.0109	0.0083	0.0055	0.0077
18	C04	Coconuts	0.0082	0.0118	0.0099	0.0048	0.0072
19	C10	Fresh nes fruit	0.0045	0.0110	0.0098	0.0056	0.0069
20	C29	Soybeans	0.0016	0.0015	0.0057	0.0095	0.0066
21	C28	Sesame seed	0.0049	0.0035	0.0033	0.0062	0.0051
22	C14	Groundnuts with shell	0.0083	0.0047	0.0027	0.0038	0.0044
23	L09	Hen eggs in shell	0.0032	0.0062	0.0058	0.0034	0.0042
24	L07	Duck meat	0.0021	0.0050	0.0056	0.0036	0.0040
25	L08	Duck meat indigenous	0.0021	0.0050	0.0056	0.0036	0.0039
26	C18	Mangoes, mangosteens and guavas	0.0066	0.0031	0.0036	0.0027	0.0035
27	C19	Natural rubber	0.0061	0.0035	0.0045	0.0011	0.0028
28	C25	Pineapples	0.0042	0.0023	0.0023	0.0014	0.0021
29	L14	Whole fresh cow milk	0.0006	0.0008	0.0040	0.0021	0.0021
30	C31	Sweet potatoes	0.0019	0.0038	0.0022	0.0012	0.0018
31	C08	Dry chillies and peppers	0.0021	0.0028	0.0022	0.0011	0.0017
32	L10	Other bird eggs in shell	0.0013	0.0028	0.0020	0.0010	0.0015
33	C24	Pepper and piper spp	0.0020	0.0018	0.0019	0.0009	0.0014
34	C21	Oilseeds nes	0.0046	0.0021	0.0009	0.0001	0.0012
35	C26	Roots and tubers nes	0.0005	0.0011	0.0017	0.0011	0.0011
36	C05	Cotton lint	0.0027	0.0005	0.0001	0.0000	0.0005
37	C27	Seed cotton	0.0027	0.0005	0.0001	0.0000	0.0005
38	C13	Green coffee	0.0010	0.0003	0.0005	0.0003	0.0004
39	C12	Grapefruit and pomelos	0.0011	0.0004	0.0003	0.0001	0.0003
40	C09	Fibre crops nes	0.0007	0.0003	0.0002	0.0001	0.0002
41	C16	Lemons and limes	0.0006	0.0001	0.0002	0.0001	0.0002

Table 3 continued from previous page

No	Code	Commodity	1959-1973	1974-1988	1989-2003	2004-2018	1959-2018
42	L13	Silkworm coiling cocoons	0.0003	0.0002	0.0002	0.0001	0.0001
43	C20	Nuts nes	0.0001	0.0001	0.0001	0.0001	0.0001
44	C06	Cottonseed	0.0005	0.0001	0.0000	0.0000	0.0001
45	C15	Jute	0.0003	0.0002	0.0001	0.0000	0.0001
46	C03	Castor oil seed	0.0001	0.0001	0.0001	0.0000	0.0001
		Total Market Share	1.0000	1.0000	1.0000	1.0000	1.0000
		HHI	0.1775	0.1251	0.1170	0.1820	0.1301

THANK YOU!