

Supplementary Material for
Quantification of food losses and waste in Peru: a mass flow analysis along the food supply chain

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Table S1: Peruvian food balance data by commodity group (2007-2017).

Commodity groups	Production quantity (1000 tonnes/year)										
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Cereals	3281	3775	4054	3925	3745	4210	4233	5009	5469	5179	5063
Roots and tubers	5015	5238	5490	5604	5774	6200	6347	6466	6502	6238	6505
Oil seeds and pulses*	437	474	421	440	465	520	497	1141	1084	1124	1261
Fruits and vegetables	6604	6910	6938	7739	7800	7988	8525	9074	9169	9350	9300
Meat	1125	1234	1322	1386	1461	1560	1603	1734	1754	1835	1895
Fish and seafood	7248	7435	6957	4349	8339	8339	8339	3687	4914	3896	4257
Milk	1478	1588	1675	1701	1769	1823	1832	1864	1927	1978	2035
Commodity groups	Stock variation (1000 tonnes/year)										
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Cereals	-1	-1	0	0	0	0	0	103	19	-98	166
Roots and tubers	0	0	0	0	0	0	0	0	0	0	0
Oil seeds and pulses*	-7	5	22	10	-23	11	0	86	-36	-19	16
Fruits and vegetables	0	0	-1	0	1	0	0	0	0	0	0
Meat	0	1	0	0	0	0	0	0	0	0	0
Fish and seafood	-438	762	968	1331	-1358	-1358	-1358	1396	-539	-100	1169
Milk	0	0	0	0	0	0	0	0	0	0	0
Commodity groups	Export quantity (1000 tonnes/year)										
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Cereals	107	143	157	147	175	178	201	194	183	216	219
Roots and tubers	3	4	4	5	8	8	12	17	14	18	22
Oil seeds and pulses*	64	75	76	95	66	78	68	98	99	109	86
Fruits and vegetables	735	843	842	1032	1263	1252	1400	1555	1638	1730	1829
Meat	2	4	2	3	3	3	3	5	6	7	3
Fish and seafood	6168	7570	7289	5101	6223	6223	6223	4474	3745	3192	4828
Milk	117	141	112	148	152	166	165	194	177	192	190
Commodity groups	Import quantity (1000 tonnes/year)										
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Cereals	3396	3314	3383	3976	4114	4154	4308	4773	5153	5498	6371
Roots and tubers	71	131	106	102	107	164	139	41	48	55	55
Oil seeds and pulses*	233	241	290	307	249	273	372	379	465	385	466
Fruits and vegetables	91	111	121	145	153	163	166	139	144	144	156
Meat	18	20	25	34	29	38	45	42	49	66	76
Fish and seafood	59	64	86	144	97	97	97	137	153	171	198
Milk	186	182	191	280	245	488	339	62	65	59	59
Commodity groups	Domestic supply quantity (1000 tonnes/year)										
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Cereals	6569	6944	7280	7755	7684	8186	8339	9485	10,421	10,560	11,049
Roots and tubers	5082	5365	5593	5701	5873	6356	6475	6490	6536	6275	6537
Oil seeds and pulses*	598	646	656	661	627	726	801	1335	1486	1420	1625
Fruits and vegetables	5959	6178	6217	6851	6689	6900	7289	7658	7675	7764	7628
Meat	1141	1250	1345	1418	1487	1595	1645	1771	1797	1894	1968
Fish and seafood	701	691	722	723	855	855	855	745	782	775	796
Milk	1547	1629	1754	1834	1862	2145	2006	1732	1815	1845	1904

* sommatory of the items aggregated (oilcrops + treenuts + pulses)

Source: authors' own elaboration based on data compiled from FAOSTAT data, 2020 [1].

Table S2: Food crop products included in the analysis.

Commodity Group	Products
Cereals	wheat, rice (milled), barley, maize, rye, oats, millet, sorghum, other cereals.
Roots and tubers	potatoes, sweet potatoes, cassava, yams, other roots.
Pulses (only)	soybean, groundnuts.
Fruits & vegetables	oranges and mandarins, lemons and limes, grapefruit, other citrus, bananas, plantains, apples, pineapples, dates, grapes, other fruit, tomatoes, onions, other vegetables.
Meat	bovine meat, mutton/goat meat, pig meat, poultry meat, other meat, offals.
Fish & seafood	freshwater fish, demersal fish, pelagic fish, other marine fish, crustaceans, other mollusk, cephalopods, other aquatic products, aquatic mammal meat, other aquatic animals, aquatic plants.
Milk	Milk.

Table S3: Quantity of food to calculate loss and waste in each stage of the Peruvian food supply chain (2007-2017).

Commodity groups	Agricultural production (1000 tonnes/year) [production quantity]											
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2007-2017 (Average)
Cereals	3281	3775	4054	3925	3745	4210	4233	5009	5469	5179	5063	4358.45
Roots and tubers	5015	5238	5490	5604	5774	6200	6347	6466	6502	6238	6505	5943.55
Pulses (only)	437	474	421	440	465	520	497	1141	1084	1124	1261	714.91
Fruits and vegetables	6604	6910	6938	7739	7800	7988	8525	9074	9169	9350	9300	8127.00
Meat	1125	1234	1322	1386	1461	1560	1603	1734	1754	1835	1895	1537.18
Fish and seafood	7248	7435	6957	4349	8339	8339	8339	3687	4914	3896	4257	6160.00
Milk	1478	1588	1675	1701	1769	1823	1832	1864	1927	1978	2035	1788.18
Total	25,188	26,654	26,857	25,144	29,353	30,640	31,376	28,975	30,819	29,600	30,316	28,629.27
Commodity groups	Postharvest handling and storage (1000 tonnes/year) [production quantity + stock variation]											
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2007-2017 (Average)
Cereals	3280	3774	4054	3925	3745	4210	4233	5112	5488	5081	5229	4375.55
Roots and tubers	5015	5238	5490	5604	5774	6200	6347	6466	6502	6238	6505	5943.55
Pulses (only)	430	479	443	450	442	531	497	1227	1048	1105	1277	720.82
Fruits and vegetables	6604	6910	6937	7739	7801	7988	8525	9074	9169	9350	9300	8127.00
Meat	1125	1235	1322	1386	1461	1560	1603	1734	1754	1835	1895	1537.27
Fish and seafood	6810	8197	7925	5680	6981	6981	6981	5083	4375	3796	5426	6203.18
Milk	1478	1588	1675	1701	1769	1823	1832	1864	1927	1978	2035	1788.18
Total	24,742	27,421	27,846	26,485	27,973	29,293	30,018	30,560	30,263	29,383	31,667	28,695.55
Commodity groups	Processing and packaging (1000 tonnes/year) [production quantity + stock variation + import quantity]											
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2007-2017 (Average)
Cereals	6676	7088	7437	7901	7859	8364	8541	9885	10,641	10,579	11,600	8779.18
Roots and tubers	5086	5369	5596	5706	5881	6364	6486	6507	6550	6293	6560	6036.18
Pulses (only)	663	720	733	757	691	804	869	1606	1513	1490	1743	1053.55
Fruits and vegetables	6695	7021	7058	7884	7954	8151	8691	9213	9313	9494	9456	8266.36
Meat	1143	1255	1347	1420	1490	1598	1648	1776	1803	1901	1971	1577.45
Fish and seafood	6869	8261	8011	5824	7078	7078	7078	5220	4528	3967	5624	6321.64
Milk	1664	1770	1866	1981	2014	2311	2171	1926	1992	2037	2094	1984.18
Total	28,796	31,484	32,048	31,473	32,967	34,670	35,484	36,133	36,340	35,761	39,048	34,018.55
Commodity groups	Distribution (1000 tonnes/year) [production quantity + stock variation + import quantity - export quantity]											
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2007-2017 (Average)
Cereals	6569	6945	7280	7754	7684	8186	8340	9691	10,458	10,363	11,381	8604.64
Roots and tubers	5083	5365	5592	5701	5873	6356	6474	6490	6536	6275	6538	6025.73
Pulses (only)	599	645	657	662	625	726	801	1508	1414	1381	1657	970.45
Fruits and vegetables	5960	6178	6216	6852	6691	6899	7291	7658	7675	7764	7627	6982.82
Meat	1141	1251	1345	1417	1487	1595	1645	1771	1797	1894	1968	1573.73
Fish and seafood	701	691	722	723	855	855	855	746	783	775	796	772.91
Milk	1547	1629	1754	1833	1862	2145	2006	1732	1815	1845	1904	1824.73
Total	21,600	22,704	23,566	24,942	25,077	26,762	27,412	29,596	30,478	30,297	31,871	26,755.00
Commodity groups	Consumption (1000 tonnes/year) [domestic supply quantity]											
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2007-2017 (Average)
Cereals	6569	6945	7280	7754	7684	8186	8340	9691	10,458	10,363	11,381	8604.64
Roots and tubers	5083	5365	5592	5701	5873	6356	6474	6490	6536	6275	6538	6025.73
Pulses (only)	599	645	657	662	625	726	801	1508	1414	1381	1657	970.45
Fruits and vegetables	5960	6178	6216	6852	6691	6899	7291	7658	7675	7764	7627	6982.82
Meat	1141	1251	1345	1417	1487	1595	1645	1771	1797	1894	1968	1573.73
Fish and seafood	701	691	722	723	855	855	855	746	783	775	796	772.91
Milk	1547	1629	1754	1833	1862	2145	2006	1732	1815	1845	1904	1824.73
Total	21,600	22,704	23,566	24,942	25,077	26,762	27,412	29,596	30,478	30,297	31,871	26,755.00

Source: authors' elaboration.

Table S4: Quantity of food loss and waste per year at each step of the Peruvian food supply chain (2007–2017).

Commodity groups	Agricultural production (1000 tonnes/year) [production quantity]											
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2007-2017 (Average)
Cereals	196.86	226.50	243.24	235.50	224.70	252.60	253.98	300.54	328.14	310.74	303.78	261.51
Roots and tubers	702.10	733.32	768.60	784.56	808.36	868.00	888.58	905.24	910.28	873.32	910.70	832.10
Pulses (only)	26.22	28.44	25.26	26.40	27.90	31.20	29.82	68.46	65.04	67.44	75.66	42.89
Fruits and vegetables	1320.80	1382.00	1387.60	1547.80	1560.00	1597.60	1705.00	1814.80	1833.80	1870.00	1860.00	1625.40
Meat	59.63	65.40	70.07	73.46	77.43	82.68	84.96	91.90	92.96	97.26	100.44	81.47
Fish and seafood	413.14	423.80	396.55	247.89	475.32	475.32	475.32	210.16	280.10	222.07	242.65	351.12
Milk	51.73	55.58	58.63	59.54	61.92	63.81	64.12	65.24	67.45	69.23	71.23	62.59
Total	2770.47	2915.04	2949.94	2975.15	3235.63	3371.21	3501.78	3456.34	3577.77	3510.06	3564.45	3257.08
Commodity groups	Postharvest handling and storage (1000 tonnes/year) [production quantity + stock variation]											
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2007-2017 (Average)
Cereals	131.20	150.96	162.16	157.00	149.80	168.40	169.32	204.48	219.52	203.24	209.16	175.02
Roots and tubers	702.10	733.32	768.60	784.56	808.36	868.00	888.58	905.24	910.28	873.32	910.70	832.10
Pulses (only)	12.90	14.37	13.29	13.50	13.26	15.93	14.91	36.81	31.44	33.15	38.31	21.62
Fruits and vegetables	660.40	691.00	693.70	773.90	780.10	798.80	852.50	907.40	916.90	935.00	930.00	812.70
Meat	12.38	13.59	14.54	15.25	16.07	17.16	17.63	19.07	19.29	20.19	20.85	16.91
Fish and seafood	340.50	409.85	396.25	284.00	349.05	349.05	349.05	254.15	218.75	189.80	271.30	310.16
Milk	88.68	95.28	100.50	102.06	106.14	109.38	109.92	111.84	115.62	118.68	122.10	107.29
Total	1948.16	2108.37	2149.04	2130.27	2222.78	2326.72	2401.91	2438.99	2431.80	2373.38	2502.42	2275.80
Commodity groups	Processing and packaging (1000 tonnes/year) [production quantity + stock variation + import quantity]											
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2007-2017 (Average)
Cereals	300.42	318.96	334.67	355.55	353.66	376.38	384.35	444.83	478.85	476.06	522.00	395.06
Roots and tubers	610.32	644.28	671.52	684.72	705.72	763.68	778.32	780.84	786.00	755.16	787.20	724.34
Pulses (only)	53.04	57.60	58.64	60.56	55.28	64.32	69.52	128.48	121.04	119.20	139.44	84.28
Fruits and vegetables	1339.00	1404.20	1411.60	1576.80	1590.80	1630.20	1738.20	1842.60	1862.60	1898.80	1891.20	1653.27
Meat	57.15	62.75	67.35	71.00	74.50	79.90	82.40	88.80	90.15	95.05	98.55	78.87
Fish and seafood	618.21	743.49	720.99	524.16	637.02	637.02	637.02	469.80	407.52	357.03	506.16	568.95
Milk	33.28	35.40	37.32	39.62	40.28	46.22	43.42	38.52	39.84	40.74	41.88	39.68
Total	3011.42	3266.68	3302.09	3312.41	3457.26	3597.72	3733.23	3793.87	3786.00	3742.04	3986.43	3544.47
Commodity groups	Distribution (1000 tonnes/year) [production quantity + stock variation + import quantity - export quantity]											
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2007-2017 (Average)
Cereals	262.76	277.80	291.20	310.16	307.36	327.44	333.60	387.64	418.32	414.52	455.24	344.19
Roots and tubers	152.49	160.95	167.76	171.03	176.19	190.68	194.22	194.70	196.08	188.25	196.14	180.77
Pulses (only)	11.98	12.90	13.14	13.24	12.50	14.52	16.02	30.16	28.28	27.62	33.14	19.41
Fruits and vegetables	715.20	741.36	745.92	822.24	802.92	827.88	874.92	918.96	921.00	931.68	915.96	838.00
Meat	57.05	62.55	67.25	70.85	74.35	79.75	82.25	88.55	89.85	94.70	98.40	78.69
Fish and seafood	70.10	69.10	72.20	72.30	85.50	85.50	85.50	74.60	78.30	77.50	79.60	77.29
Milk	123.76	130.32	140.32	146.64	148.96	171.60	160.48	138.56	145.20	147.60	152.32	145.98
Total	1393.34	1454.98	1497.79	1606.46	1607.78	1697.37	1746.99	1833.17	1877.03	1881.87	1930.80	1684.33
Commodity groups	Consumption (1000 tonnes/year) [domestic supply quantity]											
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2007-2017 (Average)
Cereals	656.90	694.50	728.00	775.40	768.40	818.60	834.00	969.10	1045.80	1036.30	1138.10	860.46
Roots and tubers	203.32	214.60	223.68	228.04	234.92	254.24	258.96	259.60	261.44	251.00	261.52	241.03
Pulses (only)	11.98	12.90	13.14	13.24	12.50	14.52	16.02	30.16	28.28	27.62	33.14	19.41
Fruits and vegetables	596.00	617.80	621.60	685.20	669.10	689.90	729.10	765.80	767.50	776.40	763.30	698.34
Meat	68.46	75.06	80.70	85.02	89.22	95.70	98.70	106.26	107.82	113.64	118.08	94.42
Fish and seafood	28.04	27.64	28.88	28.92	34.20	34.20	34.20	29.84	31.32	31.00	31.84	30.92
Milk	61.88	65.16	70.16	73.32	74.48	85.80	80.24	69.28	72.60	73.80	76.16	72.99
Total	1626.58	1707.66	1766.16	1889.14	1882.82	1992.96	2051.22	2230.04	2314.76	2309.76	2422.14	2017.57

The assumed food losses and waste percentages for each commodity group in each step of the food supply chain for Peru correspond to the coefficients of food waste for Latin American countries, following Gustavsson et al. estimates [2] (p. 27). For the cereal processing and packaging step, the mean value was used (equal to 4.5%).

Source: authors' elaboration.

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