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Incentive systems in municipal solid waste management – a 10-year case study of Mikulov district

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9th International Conference on Sustainable Solid Waste Management, Corfu, 15. 6. 2022

Introduction

- Body of literature suggests that incentive systems significantly improve WM performance, both in economic and environmental terms
- But this does not happen overnight by itself
  - And the road to “good“ results is not typically straightforward
- Implementation process can provide important information about what to do and what to avoid

Motivation

- Papers on WM incentive systems often include analysis of results only from a selected period
  - Typically, once the systems have already been longer operational
- But as with every introduction of a change, the process leading to a stable situation is important
  - Implementation represents and opportunity to do things properly, but also the risk choosing poorly and getting desired results
- Long-terms studies can offer valuable information

Goal of the study

- Identify impacts experienced on the route to implementing a functional and stable incentive WM system (IWMS)
- Learn from the process and provide suggestions what to improve and how to efficiently implement incentive WM system

Though process behind IWMS

- Waste separation is not enough, in order reflect better waste hierarchy, minimization of residual should be also targeted
  - Separated waste is good, but no waste is even better
- However, in practice aiming for one can result in worse performance in the other
  - A good solution thus needs to take into account multiple aspects and somehow combine them

Sample of municipalities, Mikulov district, CZE

Municipality	ISNO implementation	MESOH upgrade/implementation
Březí	2013	2019
Dolní Věstonice	Information not available	2019
Drnholec	2012	2019
Jevišovka	2015	2019
Klentice	2015	2019
Mikulov*	2012	2019
Pasohlávky	2011	2019
Přibice	2012	2019
Sedlec	Not implemented	2019
Strachotín	2016	2019

First version of IWMS, ISNO

- ISNO – abbreviation of “integrated WM system“
  - 2011–2018, some municipalities joined later
- 3 categories of bonuses rewarded by EKO points
  - Residual waste, separated waste, efficient use of bags and bins
  - Transferable into discounts (bonus)
- Measurement using bags and bins with QR code
  - Keeping record of waste production and waste separation for individual households – volume based

Learning by doing

- Initially each EKO point represented 20 CZK discount (cca 3% of annual fee), 25 points max
  - But as the households adapt to the system, it became relatively simple to reach highest discount with still a lot of room for improvement – people react to incentives and adapt
- As a reaction, value of EKO points has been gradually lowered to represent 10 CZK
- Question of what else to include in the system?

Second version of IWMS, MESOH

- MESOH – abbreviation of “incentive and evidence WM system“
  - 2019+ onwards
  - Main goal to differentiate even more between environmentally aware and environmentally „ignorant“ households
- 7 categories rewarded with EKO points
  - Residual waste, separated waste, efficient use of bags and bins, greener/more efficient energy in household, composting, proved interest in the topic, donations and greener shopping
  - Transferable into discounts (bonus)
  - Centralized user portal

Separation bonus matrix

Bonus za třídění odpadů je udělen do výše 23% za plast, 20% za papír, 30% za bioodpad, 13% za sklo, 8% za textil, 2% za nápojový karton, 2% za jedlý olej a tuk a 2% za drobné elektrozařízení z hodnoty maximálního bonusu uvedeného v této tabulce.	Roční celkový objem obsloužených nádob přepočtený na jednoho účastníka systému užívajícího dané nádoby (litry/účastník systému/rok)	Procentuální zastoupení objemu obsloužených nádob na plast a na papír v celkovém objemu obsloužených nádob																	
		0 %	1-5 %	6-10 %	11-15 %	16-20 %	21-25 %	26-30 %	31-35 %	36-40 %	41-45 %	46-50 %	51-55 %	56-60 %	61-65 %	66-70 %	71-75 %	76-80 %	81-85 %	více jak 85 %
		"Třídí málo"																	"Třídí hodně"
	500 - 600	0	2	6	10	14	18	22	25	29	33	37	41	45	49	52	56	60	64	66
	600 - 700	0	3	7	12	16	21	25	30	35	39	44	48	53	57	62	66	71	76	78
	700 - 800	0	3	8	14	19	24	29	35	40	45	50	56	61	66	71	77	82	87	90
	800 - 900	0	4	10	15	21	27	33	39	45	51	57	63	69	75	81	87	93	99	102
	900 - 1000	0	4	11	17	24	31	37	44	51	57	64	70	77	84	90	97	104	110	114
	1000 - 1100	0	4	12	19	26	34	41	49	56	63	71	78	85	93	100	107	115	120	120
	1100 - 1200	0	5	13	21	29	37	45	53	61	69	77	85	93	101	109	118	120	120	120
	1200 - 1300	0	5	14	23	32	40	49	58	67	75	84	93	102	110	119	120	120	120	120
	1300 - 1400	0	6	15	25	34	43	53	62	72	81	91	100	110	119	120	120	120	120	120
	1400 - 1500	0	6	16	26	37	47	57	67	77	87	97	108	118	120	120	120	120	120	120
	1500 - 1600	0	7	17	28	39	50	61	72	82	93	104	115	120	120	120	120	120	120	120
	1600 - 1700	0	7	18	30	42	53	65	76	88	99	111	120	120	120	120	120	120	120	120
	1700 - 1800	0	7	20	32	44	56	69	81	93	105	118	120	120	120	120	120	120	120	120
	1800 - 1900	0	8	21	34	47	60	73	85	98	111	120	120	120	120	120	120	120	120	120
	1900 - 2000	0	8	22	35	49	63	76	90	104	117	120	120	120	120	120	120	120	120	120
	2000 - 2100	0	9	23	37	52	66	80	95	109	120	120	120	120	120	120	120	120	120	120
	2100 - 2200	0	9	24	39	54	69	84	99	114	120	120	120	120	120	120	120	120	120	120
	2200 - 2300	0	9	25	41	57	72	88	104	120	120	120	120	120	120	120	120	120	120	120
	2300 - 2400	0	10	26	43	59	76	92	109	120	120	120	120	120	120	120	120	120	120	120
	2400 - 2500	0	10	27	45	62	79	96	113	120	120	120	120	120	120	120	120	120	120	120
	2500 - 2600	0	11	29	46	64	82	100	118	120	120	120	120	120	120	120	120	120	120	120
	2600 - 2700	0	11	30	48	67	85	104	120	120	120	120	120	120	120	120	120	120	120	120
	2700 - 2800	0	12	31	50	69	89	108	120	120	120	120	120	120	120	120	120	120	120	120
	2800 - 2900	0	12	32	52	72	92	112	120	120	120	120	120	120	120	120	120	120	120	120
	2900 - 3000	0	12	33	54	74	95	116	120	120	120	120	120	120	120	120	120	120	120	120
	3000 - 3100	0	13	34	56	77	98	120	120	120	120	120	120	120	120	120	120	120	120	120
	3100 - 3200	0	13	35	57	79	101	120	120	120	120	120	120	120	120	120	120	120	120	120
	3200 - 3300	0	14	36	59	82	105	120	120	120	120	120	120	120	120	120	120	120	120	120
	3300 - 3400	0	14	38	61	84	108	120	120	120	120	120	120	120	120	120	120	120	120	120
	3400 - 3500	0	14	39	63	87	111	120	120	120	120	120	120	120	120	120	120	120	120	120

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Use of bag & bins bonus matrix

Bonus za efektivní využívání sběrných nádob je udělen do výše 100% z hodnoty maximálního bonusu uvedeného v této tabulce.	Roční celkový objem obsloužených nádob přepočtený na jednoho účastníka systému užívajícího daně nádoby (litry/účastník systému/rok)	Procentuální zastoupení objemu obsloužených nádob na plast a na papír v celkovém objemu obsloužených nádob																		
		0 %	1-5 %	6-10 %	11-15 %	16-20 %	21-25 %	26-30 %	31-35 %	36-40 %	41-45 %	46-50 %	51-55 %	56-60 %	61-65 %	66-70 %	71-75 %	76-80 %	81-85 %	více jak 85 %
		"Třídí málo"																		"Třídí hodně"
	500 - 600	0	14	23	32	41	50	59	68	77	87	96	105	114	123	130	130	130	130	130
	600 - 700	0	0	0	3	14	25	36	46	57	68	78	89	100	111	121	130	130	130	130
	700 - 800	0	0	0	0	0	0	12	24	37	49	61	74	86	98	111	123	130	130	130
	800 - 900	0	0	0	0	0	0	0	2	16	30	44	58	72	86	100	114	128	130	130
	900 - 1000	-24	-14	0	0	0	0	0	0	0	11	27	43	58	74	90	105	121	130	130
	1000 - 1100	-57	-46	-29	-11	0	0	0	0	0	0	10	27	44	62	79	96	114	130	130
	1100 - 1200	-90	-78	-59	-40	-21	-2	0	0	0	0	0	12	31	50	69	88	107	125	130
	1200 - 1300	-120	-110	-90	-69	-48	-28	-7	0	0	0	0	0	17	37	58	79	99	120	130
	1300 - 1400	-120	-120	-120	-98	-75	-53	-31	-8	0	0	0	0	3	25	47	70	92	114	128
	1400 - 1500	-120	-120	-120	-120	-102	-78	-55	-31	-7	0	0	0	0	13	37	61	85	109	123
	1500 - 1600	-120	-120	-120	-120	-120	-104	-78	-53	-27	-2	0	0	0	1	26	52	77	103	118
	1600 - 1700	-120	-120	-120	-120	-120	-120	-102	-75	-48	-20	0	0	0	0	16	43	70	97	114
	1700 - 1800	-120	-120	-120	-120	-120	-120	-120	-97	-68	-39	-10	0	0	0	5	34	63	92	109
	1800 - 1900	-120	-120	-120	-120	-120	-120	-120	-119	-89	-58	-27	0	0	0	0	25	56	86	105
	1900 - 2000	-120	-120	-120	-120	-120	-120	-120	-120	-109	-77	-45	-12	0	0	0	16	48	81	100
	2000 - 2100	-120	-120	-120	-120	-120	-120	-120	-120	-120	-96	-62	-28	0	0	0	7	41	75	95
	2100 - 2200	-120	-120	-120	-120	-120	-120	-120	-120	-120	-114	-79	-43	-8	0	0	0	34	69	91
	2200 - 2300	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120	-96	-59	-22	0	0	0	27	64	86
	2300 - 2400	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120	-113	-74	-36	0	0	0	19	58	81
	2400 - 2500	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120	-90	-50	-9	0	0	12	53	77
	2500 - 2600	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120	-106	-63	-21	0	0	5	47	72
	2600 - 2700	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120	-77	-34	0	0	0	41	68
	2700 - 2800	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120	-91	-46	0	0	0	36	63
	2800 - 2900	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120	-105	-58	-11	0	0	30	58
	2900 - 3000	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120	-119	-70	-22	0	0	25	54
	3000 - 3100	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120	-82	-32	0	0	19	49
	3100 - 3200	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120	-95	-43	0	0	13	44
	3200 - 3300	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120	-107	-53	0	0	8	40
	3300 - 3400	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120	-119	-64	-8	0	2	35
	3400 - 3500	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120	-74	-17	0	0	31

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Decrease in waste bonus matrix

Bonus za snižování produkce odpadů je udělen do výše 20% za každý způsob snižování produkce odpadů uvedený v registračním formuláři z hodnoty maximálního bonusu uvedeného v této tabulce.	Procentuální zastoupení objemu obsloužených nádob na plast a na papír v celkovém objemu obsloužených nádob																		
	0 %	1-5 %	6-10 %	11-15 %	16-20 %	21-25 %	26-30 %	31-35 %	36-40 %	41-45 %	46-50 %	51-55 %	56-60 %	61-65 %	66-70 %	71-75 %	76-80 %	81-85 %	více jak 85 %
	"Třídí málo"																		"Třídí hodně"
Roční celkový objem obsloužených nádob přepočtený na jednoho účastníka systému užívajícího dané nádoby (litry/účastník systému/rok)																			
500 - 600	0	0	0	0	0	0	0	0	0	0	0	100	100	100	100	100	100	100	0
600 - 700	0	0	0	0	0	0	0	0	0	0	0	100	100	100	100	100	100	100	0
700 - 800	0	0	0	0	0	0	0	0	0	0	0	100	100	100	100	100	100	100	0
800 - 900	0	0	0	0	0	0	0	0	0	0	0	100	100	100	100	100	100	100	0
900 - 1000	0	0	0	0	0	0	0	0	0	0	0	100	100	100	100	100	100	100	0
1000 - 1100	0	0	0	0	0	0	0	0	0	0	0	100	100	100	100	100	100	100	0
1100 - 1200	0	0	0	0	0	0	0	0	0	0	0	100	100	100	100	100	100	100	0
1200 - 1300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1300 - 1400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1400 - 1500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1500 - 1600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1600 - 1700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1700 - 1800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1800 - 1900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1900 - 2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000 - 2100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2100 - 2200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2200 - 2300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2300 - 2400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2400 - 2500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2500 - 2600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2600 - 2700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2700 - 2800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2800 - 2900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2900 - 3000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3000 - 3100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3100 - 3200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3200 - 3300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3300 - 3400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
více jak 3400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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Total bonus matrix (S+Ef.U+D)

Záporná hodnota součtu bonusů (BT + BV + BS) je nahrazena nulou.	Procentuální zastoupení objemu obsloužených nádob na plast a na papír v celkovém objemu obsloužených nádob																		
Roční celkový objem obsloužených nádob přepočtený na jednoho účastníka systému užívajícího dané nádoby (litry/účastník systému/rok)	0 %	1-5 %	6-10 %	11-15 %	16-20 %	21-25 %	26-30 %	31-35 %	36-40 %	41-45 %	46-50 %	51-55 %	56-60 %	61-65 %	66-70 %	71-75 %	76-80 %	81-85 %	více jak 85 %
	"Třídí málo"																		"Třídí hodně"
500 - 600	0	16	29	42	55	68	81	94	107	120	133	246	258	271	282	286	290	294	196
600 - 700	0	3	7	15	30	46	61	76	92	107	122	237	253	268	283	296	301	306	208
700 - 800	0	3	8	14	19	24	41	59	76	94	112	229	247	265	282	300	312	317	220
800 - 900	0	4	10	15	21	27	33	41	61	81	101	221	241	261	281	301	321	329	232
900 - 1000	0	0	11	17	24	31	37	44	51	68	91	213	235	258	280	302	325	340	244
1000 - 1100	0	0	0	8	26	34	41	49	56	63	80	205	230	254	279	304	328	350	250
1100 - 1200	0	0	0	0	8	35	45	53	61	69	77	197	224	251	278	305	327	345	250
1200 - 1300	0	0	0	0	0	13	42	58	67	75	84	93	118	148	177	199	219	240	250
1300 - 1400	0	0	0	0	0	0	22	54	72	81	91	100	113	144	167	190	212	234	248
1400 - 1500	0	0	0	0	0	0	2	36	70	87	97	108	118	133	157	181	205	229	243
1500 - 1600	0	0	0	0	0	0	0	19	55	92	104	115	120	121	146	172	197	223	238
1600 - 1700	0	0	0	0	0	0	0	1	40	79	111	120	120	120	136	163	190	217	234
1700 - 1800	0	0	0	0	0	0	0	0	25	66	107	120	120	120	125	154	183	212	229
1800 - 1900	0	0	0	0	0	0	0	0	10	53	93	120	120	120	120	145	176	206	225
1900 - 2000	0	0	0	0	0	0	0	0	0	41	75	108	120	120	120	136	168	201	220
2000 - 2100	0	0	0	0	0	0	0	0	0	24	58	92	120	120	120	127	161	195	215
2100 - 2200	0	0	0	0	0	0	0	0	0	6	41	77	112	120	120	120	154	189	211
2200 - 2300	0	0	0	0	0	0	0	0	0	0	24	61	98	120	120	120	147	184	206
2300 - 2400	0	0	0	0	0	0	0	0	0	0	7	46	84	120	120	120	139	178	201
2400 - 2500	0	0	0	0	0	0	0	0	0	0	0	30	70	111	120	120	132	173	197
2500 - 2600	0	0	0	0	0	0	0	0	0	0	0	14	57	99	120	120	125	167	192
2600 - 2700	0	0	0	0	0	0	0	0	0	0	0	0	43	86	120	120	120	161	188
2700 - 2800	0	0	0	0	0	0	0	0	0	0	0	0	29	74	120	120	120	156	183
2800 - 2900	0	0	0	0	0	0	0	0	0	0	0	0	15	62	109	120	120	150	178
2900 - 3000	0	0	0	0	0	0	0	0	0	0	0	0	1	50	98	120	120	145	174
3000 - 3100	0	0	0	0	0	0	0	0	0	0	0	0	0	38	88	120	120	139	169
3100 - 3200	0	0	0	0	0	0	0	0	0	0	0	0	0	25	77	120	120	133	164
3200 - 3300	0	0	0	0	0	0	0	0	0	0	0	0	0	13	67	120	120	128	160
3300 - 3400	0	0	0	0	0	0	0	0	0	0	0	0	0	1	56	112	120	122	155
3400 - 3500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	46	103	120	120	151

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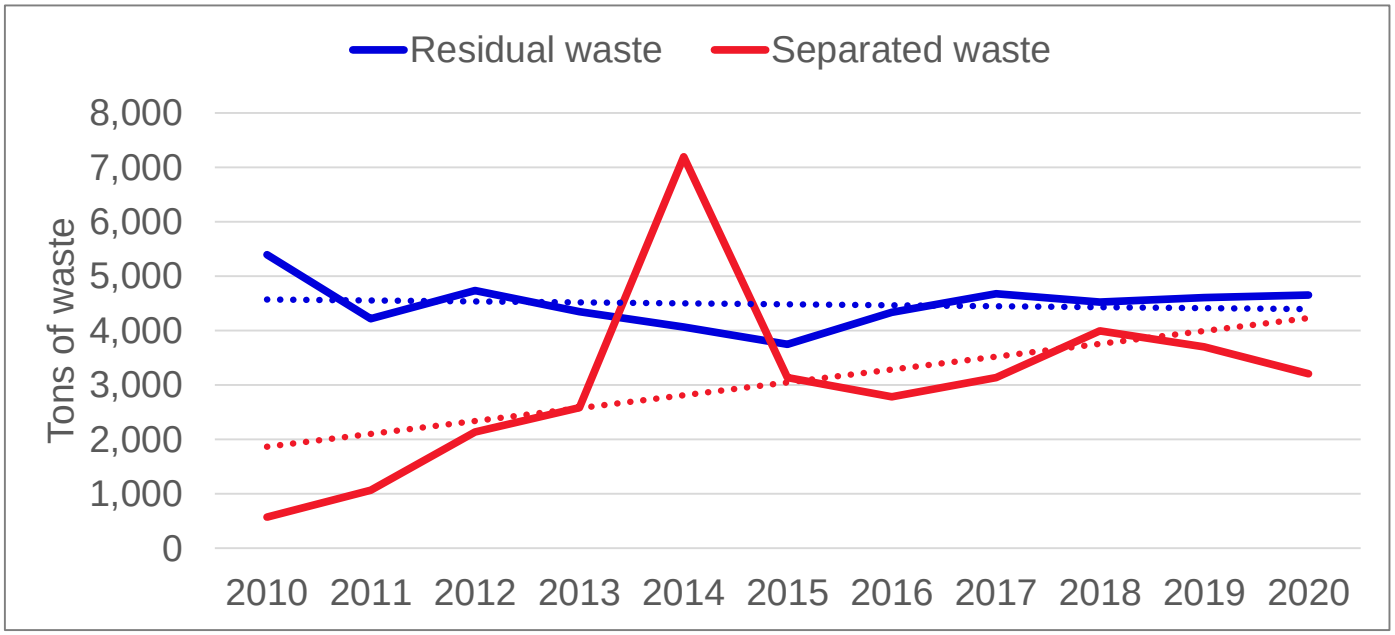
Impact on the municipalities

- Precise waste production data from municipalities not available (yet…)
  - Unresponsive WM company
- But municipalities report:
  - Increased number of bins for separate waste
  - High public participation
  - No increase in illegal waste dumping

Waste generation, Mikulov district

– Municipalities in the sample represent cca 2/3 of whole district‘s population – approximation



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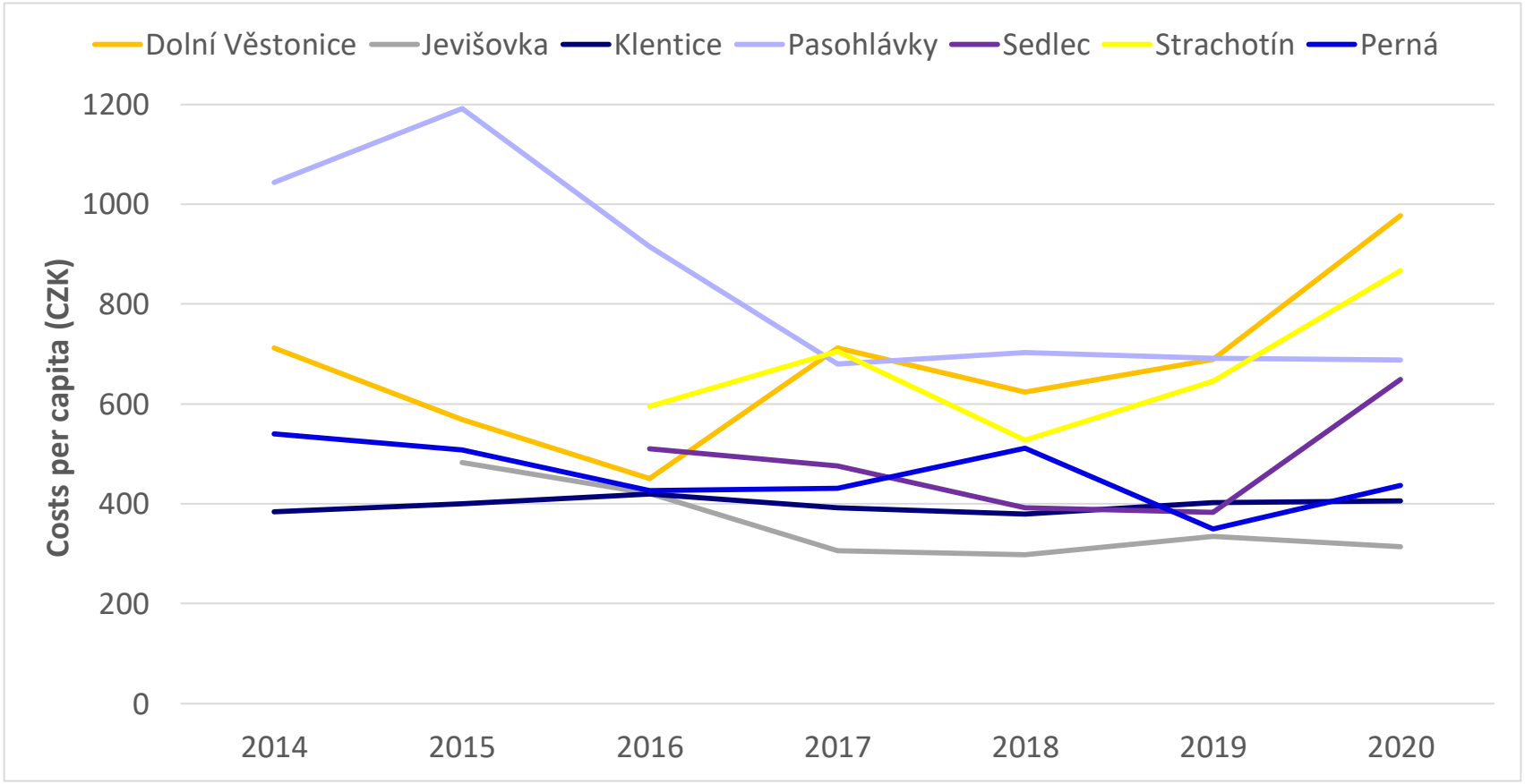
Impact on the municipalities

- Financial data stable/decreasing, even in nominal terms – a very good result considering gradual inflation over the years (until 2020)
  - Municipalities did not need to raise WM fees collected from people
  - Relatively speaking, performance of WM was increasing throughout the years – same money secured more expensive service and also increased waste separation

Impact on the municipalities



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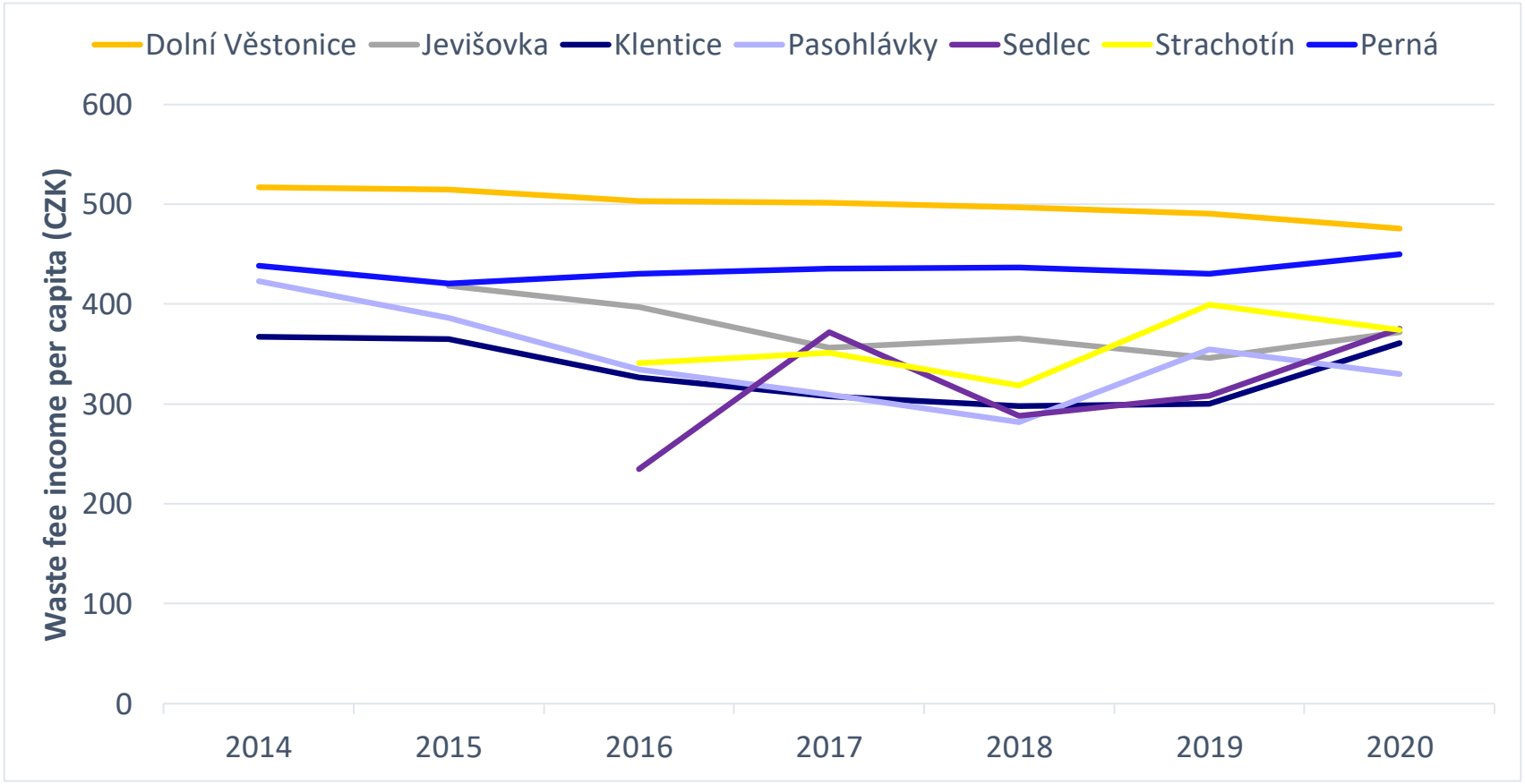
Impact on the municipalities



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What have we learned?

- Benefits of introducing WM incentive system seem to occur primarily in environmental area
- Benefits in economic area depend on how generous are incentives (possible to adjust) and how expensive is WM incentive system
  - In CZE savings from less waste seem to be offset by relatively high costs of the inc+evid. system – increasing WM service costs will likely solve this by making the benefits show up more clearly

What have we learned?

- Incentive system should be multidimensional
  - Provide education and information
  - Try to tailor system to the specific situation in given municipality
  - Work with people, great potential of place-relevant suggestions
  - Take into account not only separation or not only production
  - People react to how the system is set up and **WILL** eventually exploit any “loopholes“ – reflect and adjust set system
  - If system is focus on one area, people will try to „substitute“ good performance here for worse performance elsewhere

  - Presented MESOH incentive WM system includes waste reduction, separation and efficient use of bags and bins and few more aspects – aim to eliminate possibilities to exploit loopholes

Thank you for your attention

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