

FRA TALL TIL ØKONOMISK MODELLERING/ FROM FIGURES TO ECONOMIC MODELS

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RESEARCH PROBLEM



Kårstad et al. (2015)

- # of land owner households persists
- Technological development favours larger farms
- Scattered and small fields
- * => increasing transport for growing farms has become a political issue
- Second second



ECONOMIC MODEL

- GIS-referenced network elements in a defined geographic region:
 - Farms: Ag area, animal herds, equipment (?)
 - Fields: Size, owner, manager, crop cover(?), yield potential (?)
 - Road segments: Distance, max speed and elevation
- Objective: Minimize region's total transportation costs
- Constraints:
 - Type of transportation: Roughage production (?), manure spreading (?)
 - Reallocation criteria: ownership, field sharing, yield potential (?)
 - ³ Farm effects: transport costs, agricultural area per farm, farm survival (?)
- * Approach: Dantzig, G.B. 1963. Linear Programming and Extensions. RAND.
- ✤ Technical implementation: GAMS



CASE STUDY REGION: ØRSTA MUNICIPALITY





CASE STUDY REGION: ØRSTA MUNICIPALITY PRESENTED BY GOOGLE MAPS











Potential economic benefits of land reallocation between farms





PRELIMINARY RESULTS

Constraints	Total distance	Total distance savings	
	km	km	%
Prior to reallocation	799	0	
Farm size maintained for each farm	464	335	41.9

But: 23 of 51 farms get longer distances



4.-5.6.2018



REALLOCATE ALL FIELDS, MAINTAIN FARM SIZE

REALLOCATE ALL FIELDS, MAINTAIN FARM SIZE, MAX CURRENT DISTANCE





PRELIMINARY RESULTS

Constraints	Total distance	Total distance savings	
	km	km	%
Prior to reallocation	799	0	
Farm size maintained for each farm	464	335	41.9
No increase in transport for each farm	485	313	39.2

But: farms reallocate owned land





REALLOCATE ALL FIELDS, MAINTAIN FARM SIZE, MAX CURRENT DISTANCE

REALLOCATE RENTED LAND, MAINTAIN FARM SIZE, MAX CURRENT DISTANCE





PRELIMINARY RESULTS

Constraints	Total distance	Total distance savings	
	km	km	%
Prior to reallocation	799	0	
Farm size maintained for each farm	464	335	41.9
No increase in transport for each farm	485	313	39.2
Reallocate only rented land	544	255	32.0

But: farms split fields (as a result of LP) – is land sharing an option?



PRELIMINARY RESULTS: VERY ROUGH ESTIMATE OF ECONOMIC BENEFIT

Economic accounts for agriculture, 2018	mill nkr	% of total variable costs
Totale variable costs	21 412	100
Fuel costs	1 149	5
Maintenance of machinery & equipment	409	2
Maintenance of vehicles etc.	142	1
Max cost saving (42 %)	713	3

Harvesting gras and spreading manure (based on Kårstad et al. 2015)			
Distance, farm-field	km/farm	16	
Fields	#/farm	9.72	
Total distance per farm (4 tours per field)	km/farm	1 217	
Labour costs (speed 30 km/h, return to labour 174 nkr/h)	nkr/farm	7 061	
Labour costs (44 719 farms)	mill kr	315	
Max cost saving (42 %)	mill kr	132	

FURTHER WORK

- Stimate transportation equipment per farm
 - ³² Use physical machinery from FADN entrant farms? (ca. 50 per year)
- Develop transport cost functions
- Calculate GHG-emission coefficients
- Intregrate field variation (yield, cover)
- Implement binary allocation constraint?