## Contents

1	Introduction 1											
	1.1	Purpose and Motivation										
	1.2	Outline of the Study	4									
2	Inte	grated Transportation and Production Planning	5									
	2.1	Classification Pattern	5									
	2.2	Existing Problems	7									
		2.2.1 Joint Replenishment Problem	7									
		2.2.2 Joint Economic Lot Sizing Problem	9									
		2.2.3 Economic Lot and Delivery Scheduling Problem 1	0									
		2.2.4 Inventory Routing Problem	1									
	2.3	Further Attempts	2									
	2.4	Economic Lot and Supply Scheduling Problem 1	4									
3	Defi	nition of the ELSSP 1	7									
	3.1	Economic Lot Scheduling Problem	7									
	3.2	Capacitated Vehicle Routing Problem	1									
	3.3	Mathematical Model of the ELSSP	4									
4	ELSSP under a Common Cycle policy 35											
-	4.1	Planning Policies	5									
		4.1.1 Cycle Begin Policy	7									
		4.1.2 Direct Policy	8									
		4.1.3 General Policy	9									
	4.2	Mathematical Formulations of the Common Cycle Policies	0									
		4.2.1 Cycle Begin Policy	1									
		4.2.2 Direct Policy	2									
•		4.2.3 General Policy	3									
	4.3	Preliminary Considerations	4									
	4.4	Solution Methods for the Cycle Begin Policy	8									
		4.1 Sequential Solution Procedure	8									
		44.2 Integrated Solution Procedure	9									
	4.5	Solution Methods for the Direct Policy	1									



		4.5.1	Sequential Solution Procedure			
		4.5.2	Integrated Solution Procedure			
	4.6	Solutio	on Methods for the General Policy			
		4.6.1	Basic Concept of the Heuristic Solution Method			
		4.6.2	Grouping 56			
		4.6.3	Initial Solutions			
		4.6.4	Heuristic Integrated Solution Methods			
			4.6.4.1 Solution Procedure with Fixed Clustered Nodes			
			4.6.4.2 Solution Procedure with End Item Wise Clustered Nodes 60			
			4.6.4.3 Solution Procedure with Nodes Clustered to Tuples 61			
			4.6.4.4 Solution Procedure without any Pre-Clustering of the Nodes 62			
		4.6.5	Heuristic Solution Methods Semi-Integrated			
			4.6.5.1 Solution Procedure with Fixed Clustered Nodes			
			4.6.5.2 Solution Procedure without any Pre-Clustering of the Nodes 63			
5	ELS	SP und	er a Power of Two policy 65			
	5.1	Planni	ng Policies			
		5.1.1	Base Period Begin Policy			
		5.1.2	Direct Policy			
	5.2	Mather	matical Formulation			
		5.2.1	Base Period Begin Policy			
		5.2.2	Direct Policy			
	5.3	Prelim	inary Considerations			
	5.4	Solutio	on Methods for the Base Period Begin Policy			
		5.4.1	Sequential Solution Procedure			
		5.4.2	Integrated Heuristic Solution Method 82			
	5.5	Solutio	on Methods for the Direct Policy			
		5.5.1	Sequential solution procedure			
		5.5.2	Integrated Solution Procedure			
6	Ana	lysis of	Different Approaches 93	,		
-	6.1	Survey	Method			
	6.2	6.2 Basic Data				
	6.3	Refere	nce Cost Function	ì		
	6.4	Case S	tudy			
		6.4.1	Rankings of the Different Methods	ł		
			6.4.1.1 Overall Rankings			
			6.4.1.2 Parameter Specific Rankings			
		6.4.2	Comparison of the Integrated Approaches			
			6.4.2.1 Variation of Setup Costs	,		
			6.4.2.2 Variation of Distances	į		
			6.4.2.3 Variation of Inventory Holding Cost Parameters	,		
		6.4.3	Comparison of the Semi-Integrated and the Integrated Approaches 121			

umma	ry and	Directi	ons for Future Research	143
6.5 Summary of the Case Study				
	6.4	4.4.4	CC Begin Sequential vs. CC Begin Integrated	136
	6.4	4.4.3	PoT Begin Sequential vs. PoT Begin Integrated	132
	6.4	4.4.2	CC General Semi-Integrated vs. CC Direct Integrated	130
	6.4	4.4.1	CC Direct Integrated vs. CC Begin Sequential	127
6.	4.4 Co	omparis	son in Pairs	126
	6.4	4.3.3	Variation of Inventory Holding Cost Parameters	124
	6.4	4.3.2	Variation of Distances	123
	6.4	4.3.1	Variation of Setup Costs	121
			(12)	CADI Madeline - CD / Contr