

## MARKETS AND PROFITABILITY

# Market Analytics: Caprolactam - 2021

December 2021



This Report was prepared by NexantECA, the Energy and Chemicals Advisory company ("NexantECA"). Except where specifically stated in this Report, the information contained herein is prepared on the basis of information that is publicly available, and contains no confidential third party technical information to the best knowledge and belief of NexantECA. The information has not been independently verified or otherwise examined to determine its accuracy, completeness or financial feasibility. Neither NexantECA, Subscriber nor any person acting on behalf of either shall have any liabilities for any loss or damage arising from or connected to the use of any information contained in this Report. NexantECA does not represent or warrant that any assumed conditions will come to pass.

The Report is for Subscriber's internal use only and shall be kept strictly confidential. The Report should not be otherwise reproduced, distributed or used without first obtaining prior written consent by NexantECA. Each Subscriber agrees to use reasonable effort to protect the confidential nature of the Report.

Copyright © by NexantECA (BV) Ltd. 2021. All rights reserved.



## Contents

<b>1</b>	<b>Executive Summary .....</b>	<b>1</b>
<b>2</b>	<b>The Caprolactam Industry .....</b>	<b>4</b>
2.1	Introduction.....	4
2.2	Caprolactam End-Uses .....	5
2.2.1	Nylon Resins and Compounds.....	5
2.2.1.1	Resins Properties.....	5
2.2.1.2	Physical Properties .....	8
2.2.1.3	Mechanical Properties .....	9
2.2.1.4	Chemical Properties.....	10
2.2.1.5	Recycling.....	11
2.2.1.6	Storage.....	12
2.2.2	Additives and Fillers .....	12
2.2.2.1	Lubricants and Mould Release .....	14
2.2.2.2	Nucleants .....	14
2.2.2.3	Stabilizers.....	14
2.2.2.4	Impact Modifiers.....	14
2.2.2.5	Flame Retardants.....	14
2.2.2.6	Plasticizers .....	15
2.2.2.7	Fillers and Reinforcement .....	15
2.2.2.8	Nanocomposites .....	16
2.2.2.9	Conductive Polyamides .....	16
2.2.2.10	Polymer Blends or Alloys .....	16
2.2.2.11	Copolymers.....	17
2.2.3	Compounding.....	17
2.2.4	Fabrication Methods.....	18
2.2.5	Injection Moulding .....	19
2.2.6	Extrusion .....	19
2.2.7	Blow Moulding.....	20
2.2.8	Rotomoulding .....	21
2.2.9	Reaction Injection Moulding (RIM) .....	21
2.2.9.1	Assembly Techniques.....	21
2.2.10	Nylon Major Markets .....	21
2.2.10.1	Automotive .....	23
2.2.10.2	Exterior .....	24
2.2.10.3	Electronics and Electrical.....	24
2.2.10.4	Consumer.....	25
2.2.10.5	Industrial.....	25
2.2.10.6	Alloys.....	25
2.2.10.7	Other Applications.....	26
2.2.11	New Developments in Nylon 6 and 6,6 Products.....	26
2.3	Market Coverage.....	27



<b>3</b>	<b>Caprolactam.....</b>	<b>28</b>
3.1	Global .....	28
3.1.1	Key Developments .....	28
3.1.2	Consumption .....	28
3.1.3	Supply .....	31
3.1.4	Supply, Demand and Trade .....	33
3.2	North America .....	35
3.2.1	Key Developments .....	35
3.2.2	Consumption .....	35
3.2.3	Supply .....	36
3.2.4	Supply, Demand and Trade .....	38
3.3	South America .....	41
3.3.1	Key Developments .....	41
3.3.2	Consumption .....	41
3.3.3	Supply .....	42
3.3.4	Supply, Demand and Trade .....	42
3.4	Western Europe .....	43
3.4.1	Key Developments .....	43
3.4.2	Consumption .....	43
3.4.3	Supply .....	44
3.4.4	Supply, Demand and Trade .....	46
3.5	Central Europe .....	48
3.5.1	Key Developments .....	48
3.5.2	Consumption .....	48
3.5.3	Supply .....	49
3.5.4	Supply, Demand and Trade .....	50
3.6	Eastern Europe .....	51
3.6.1	Key Developments .....	51
3.6.2	Consumption .....	51
3.6.2.1	Russia .....	51
3.6.2.2	Other Eastern Europe .....	52
3.6.3	Supply .....	53
3.6.3.1	Russia .....	53
3.6.3.2	Other Eastern Europe .....	54
3.6.4	Supply, Demand and Trade .....	55
3.6.4.1	Russia .....	55
3.6.4.2	Other Eastern Europe .....	56
3.7	Middle East.....	58
3.7.1	Key Developments .....	58
3.7.2	Consumption .....	58
3.7.3	Supply .....	59
3.7.4	Supply, Demand and Trade .....	59
3.8	Africa .....	60
3.8.1	Key Developments .....	60



3.8.2	Consumption .....	60
3.8.3	Supply .....	60
3.8.4	Supply, Demand and Trade .....	61
3.9	Asia Pacific.....	62
3.9.1	Key Developments .....	62
3.9.2	Consumption .....	62
3.9.2.1	China.....	62
3.9.2.2	North-East Asia.....	63
3.9.2.3	South-East Asia .....	63
3.9.2.4	South Asia.....	64
3.9.2.5	Australasia .....	65
3.9.3	Supply .....	66
3.9.3.1	China.....	66
3.9.3.2	North-East Asia.....	67
3.9.3.3	South-East Asia .....	67
3.9.3.4	South Asia.....	67
3.9.3.5	Australasia .....	67
3.9.4	Supply, Demand and Trade .....	72
3.9.4.1	China.....	72
3.9.4.2	North-East Asia.....	72
3.9.4.3	South-East Asia .....	73
3.9.4.4	South Asia.....	73
3.9.4.5	Australasia .....	73

## Appendices

<b>A</b>	<b>Methodology .....</b>	<b>77</b>
A.1	Market Dynamics Forecasting Methodology .....	77
A.1.1	Capacity Availability and Forecasting .....	77
A.1.1	End-Use Consumption Forecasting .....	77
A.1.1.1	End-Use Sector Growth .....	78
A.1.1.2	Penetration (New Application Growth).....	78
A.1.1.3	Short-term Influences.....	79
A.1.2	Monomer Consumption Forecasting .....	79
A.1.3	Production and Trade Forecasting.....	80
<b>B</b>	<b>The Caprolactam Industry .....</b>	<b>81</b>
B.1	Technology .....	81
B.2	Developing Technologies .....	82

## Figures

Figure 1	Caprolactam and 6-Aminocaproic Acid .....	4
Figure 2	Polyamide 6.....	4
Figure 3	Modifications in Polyamides Properties to Fill Market Needs.....	13
Figure 4	Global GDP Growth vs. Caprolactam Consumption Growth.....	29
Figure 5	Global Caprolactam Consumption by Region .....	30



Figure 6	Global Caprolactam Capacity Share by Marketer in 2021 .....	31
Figure 7	Global Caprolactam Capacity Additions .....	32
Figure 8	Global Caprolactam Capacity .....	32
Figure 9	Global Caprolactam Supply and Demand .....	33
Figure 10	Regional Caprolactam Net Exports/Imports .....	34
Figure 11	Location of Caprolactam Plants in North America .....	37
Figure 12	North America Caprolactam Supply, Demand and Trade .....	39
Figure 13	United States Caprolactam Supply, Demand and Trade .....	40
Figure 14	South America Caprolactam Supply, Demand and Trade .....	42
Figure 15	Location of Caprolactam Plants in Western Europe .....	45
Figure 16	Western Europe Caprolactam Supply, Demand and Trade .....	47
Figure 17	Location of Caprolactam Plants in Central Europe .....	49
Figure 18	Central Europe Caprolactam Supply, Demand and Trade .....	50
Figure 19	Location of Caprolactam Plants in Russia .....	53
Figure 20	Location of Caprolactam Plants in Other Eastern Europe .....	54
Figure 21	Russia Caprolactam Supply, Demand and Trade .....	55
Figure 22	Other Eastern Europe Caprolactam Supply, Demand and Trade .....	56
Figure 23	Total Eastern Europe Caprolactam Supply, Demand and Trade .....	57
Figure 24	Middle East Caprolactam Supply, Demand and Trade .....	59
Figure 25	Africa Caprolactam Supply, Demand and Trade .....	61
Figure 26	Location of Caprolactam Plants in China .....	69
Figure 27	Location of Caprolactam Plants in North-East Asia .....	70
Figure 28	Location of Caprolactam Plants in India .....	71
Figure 29	Asia Pacific Caprolactam Supply, Demand and Trade .....	74
Figure 30	China Caprolactam Supply, Demand and Trade .....	75
Figure 31	End-Use Consumption Drivers .....	78
Figure 32	Monomer Consumption Drivers .....	79
Figure 33	Trade Considerations .....	80
Figure 34	Summary of Caprolactam Production Chemistry from Aromatics .....	81

## Tables

Table 1	Nylon 6 Strengths and Weaknesses .....	6
Table 2	Nylon 6,6 Strengths and Weaknesses .....	6
Table 3	Typical Properties of Nylon 6 and Nylon 6,6 <sup>0</sup> .....	7
Table 4	Typical Grades of Nylon 6 and Nylon 6,6 .....	13
Table 5	Selected Properties of Dry, Filled/Reinforced Nylon 6,6 <sup>0</sup> .....	15
Table 6	Properties of Nanocomposite Nylon 6, High Cycle Nylon 6 and 35 % Mineral Reinforced Nylon 6 .....	16
Table 7	Strengths and Weaknesses of Nylon/Polymer Blends .....	17
Table 8	Major Applications for Nylon 6 by Fabrication Process .....	19
Table 9	Typical Temperatures (°C) for Nylon Extrusion .....	20
Table 10	Nylon 6 and Nylon 6,6 End-Use by Major Market .....	22
Table 11	Market Requirements of Nylon 6 and Nylon 6,6 .....	23
Table 12	Nylon Alloys (Representative List) .....	26



Table 13	Global Caprolactam Consumption .....	29
Table 14	Global Caprolactam Consumption by Region .....	30
Table 15	Global Caprolactam Supply and Demand .....	33
Table 16	North America Caprolactam Consumption .....	36
Table 17	North America Caprolactam Consumption by Country .....	36
Table 18	Caprolactam Capacity in North America .....	37
Table 19	North America Caprolactam Supply, Demand and Trade .....	39
Table 20	United States Caprolactam Supply, Demand and Trade .....	40
Table 21	South America Caprolactam Consumption .....	41
Table 22	South America Caprolactam Consumption by Country .....	41
Table 23	South America Caprolactam Supply, Demand and Trade .....	42
Table 24	Western Europe Caprolactam Consumption .....	43
Table 25	Caprolactam Capacity in Western Europe .....	44
Table 26	Western Europe Caprolactam Supply, Demand and Trade .....	47
Table 27	Central Europe Caprolactam Consumption .....	48
Table 28	Caprolactam Capacity in Central Europe .....	49
Table 29	Central Europe Caprolactam Supply, Demand and Trade .....	50
Table 30	Russia Caprolactam Consumption .....	51
Table 31	Other Eastern Europe Caprolactam Consumption .....	52
Table 32	Caprolactam Capacity in Russia .....	53
Table 33	Caprolactam Capacity in Other Eastern Europe .....	54
Table 34	Russia Caprolactam Supply, Demand and Trade .....	55
Table 35	Other Eastern Europe Caprolactam Supply, Demand and Trade .....	56
Table 36	Total Eastern Europe Caprolactam Supply, Demand and Trade .....	57
Table 37	Middle East Caprolactam Consumption .....	58
Table 38	Middle East Caprolactam Consumption by Country .....	58
Table 39	Middle East Caprolactam Supply, Demand and Trade .....	59
Table 40	Africa Caprolactam Consumption .....	60
Table 41	Africa Caprolactam Consumption by Country .....	60
Table 42	Africa Caprolactam Supply, Demand and Trade .....	61
Table 43	Asia Pacific Caprolactam Consumption .....	65
Table 44	Asia Pacific Caprolactam Consumption by Country .....	65
Table 45	Caprolactam Capacity in Asia Pacific .....	68
Table 46	Asia Pacific Caprolactam Supply, Demand and Trade .....	74
Table 47	China Caprolactam Supply, Demand and Trade .....	75