



PRESENTATION

Session: **Textile Processing**

Title: **Spinning Waste Cotton**

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Presentations are available in the conference archive: <https://baumwollboerse.de/en/competencies/international-cotton-conference/speeches/>

Conference Organization

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Spinning Waste Cotton

Harald Schwippl, Technology & Process Analytics

01 Definition of the Possibilities of Efficient Use of Raw Materials

02 Raw Material and Process Stages

03 Yarn Quality

04 Economy

05 Summary

01

Definition of the Possibilities of Efficient Use of Raw Materials

Definition of Textile Recycling

How are recycled fibers used today?

Spinning Waste

- Added in the spinning process

Created in

- Blowroom
- Card
- Comber noil

Yarn Waste (Pre-consumer)

- Yarns are torn into tear fibers

Garment Waste (Post-consumer)

- Garments are torn into tear fibers

Chemical Dissolution

Natural Polymer

- Spinning waste
- Yarn waste
- Garments
- All textile applications from cotton
- Different plants on cellulosic basis (Bamboo, hemp, flax...)

Synthetic Polymer

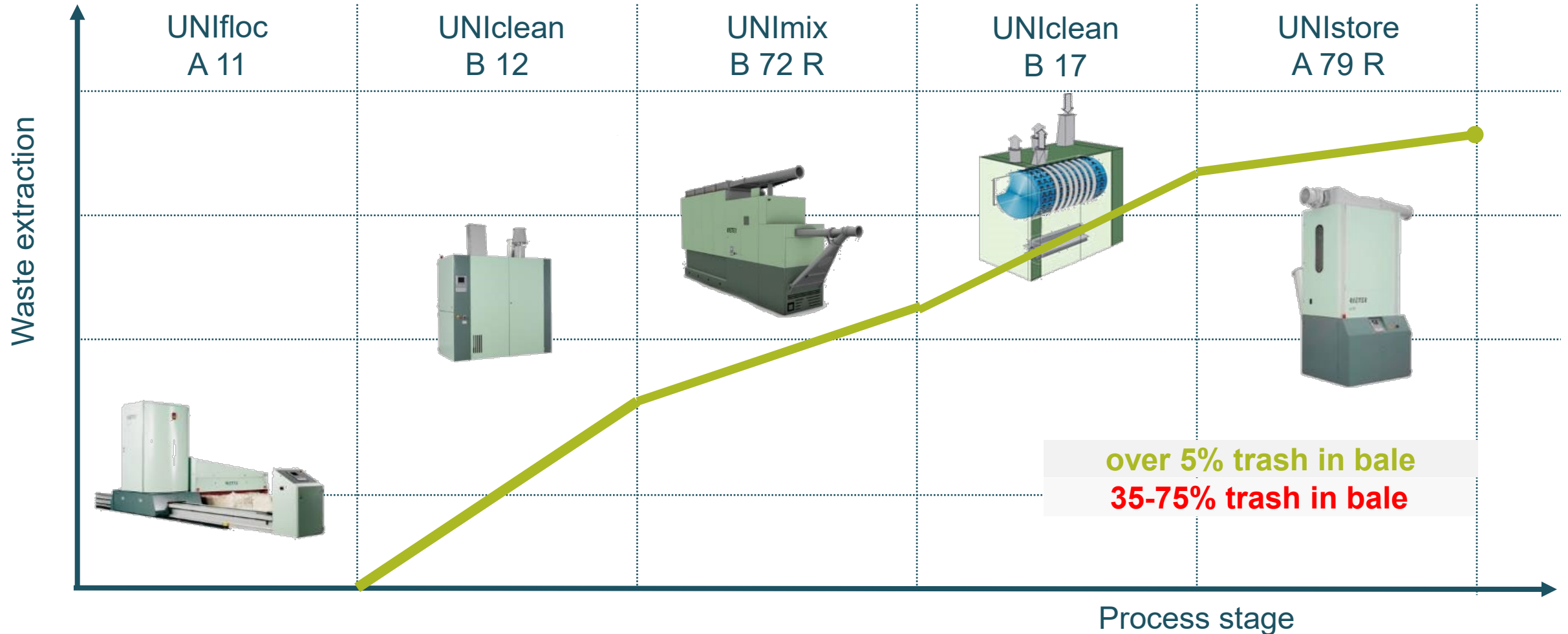
- PET bottles

02

Raw Material and Process Stages

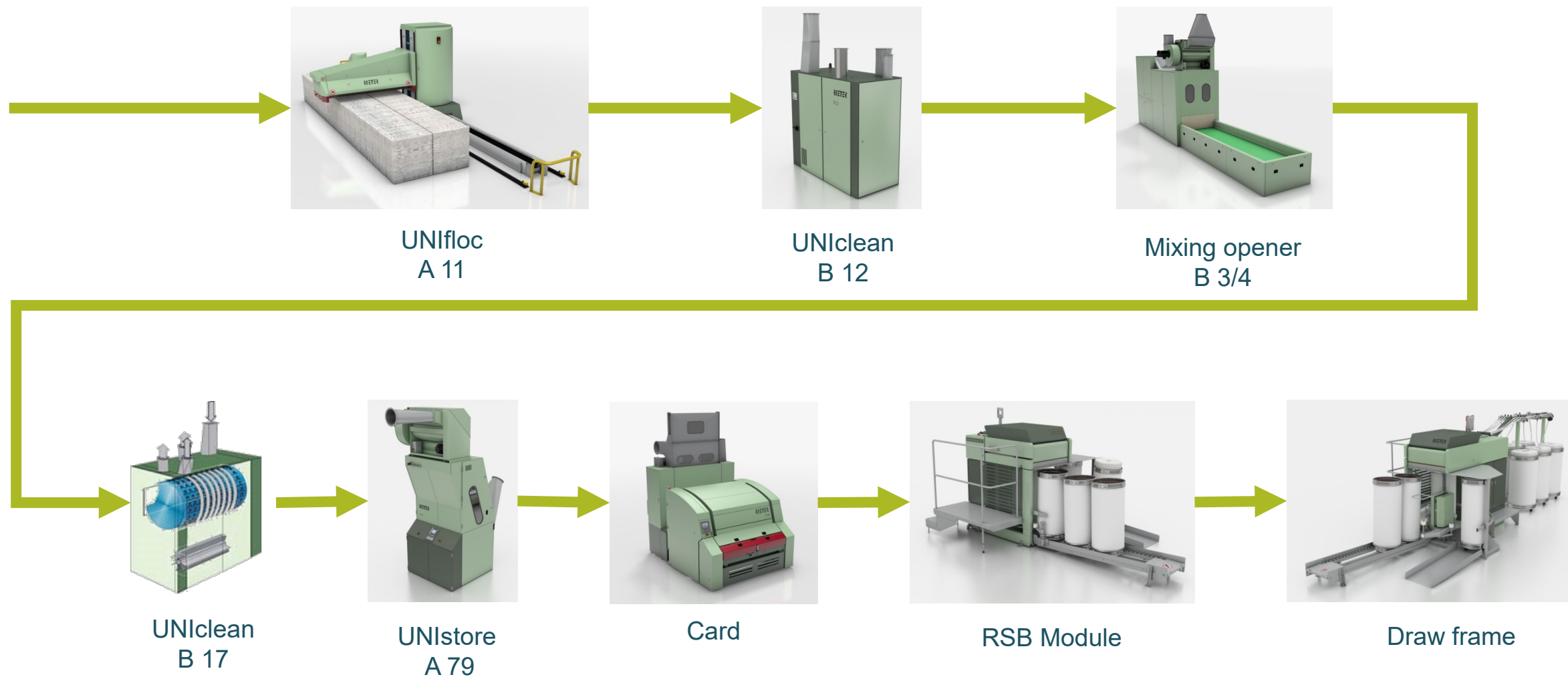
VARIOLine Cleaning – High Trash Content

For high trash content with four cleaning stages



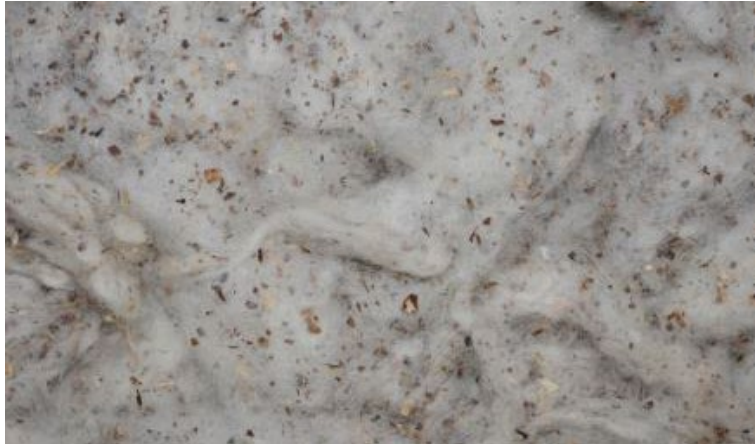
Process Overview Fiber Preparation

RIETER



Raw Material – Pakistan 1

Bale



UNIfloc A 11



UNclean B 12



Waste B 12



Raw Material – Pakistan 1

Mixing Opener B 3/4



UNclean B 17



UNIstore A 79



Waste B 3/4



Waste B 17



Waste A 79



Raw Material – Pakistan 1

Card mat



Card sliver



Draw frame sliver

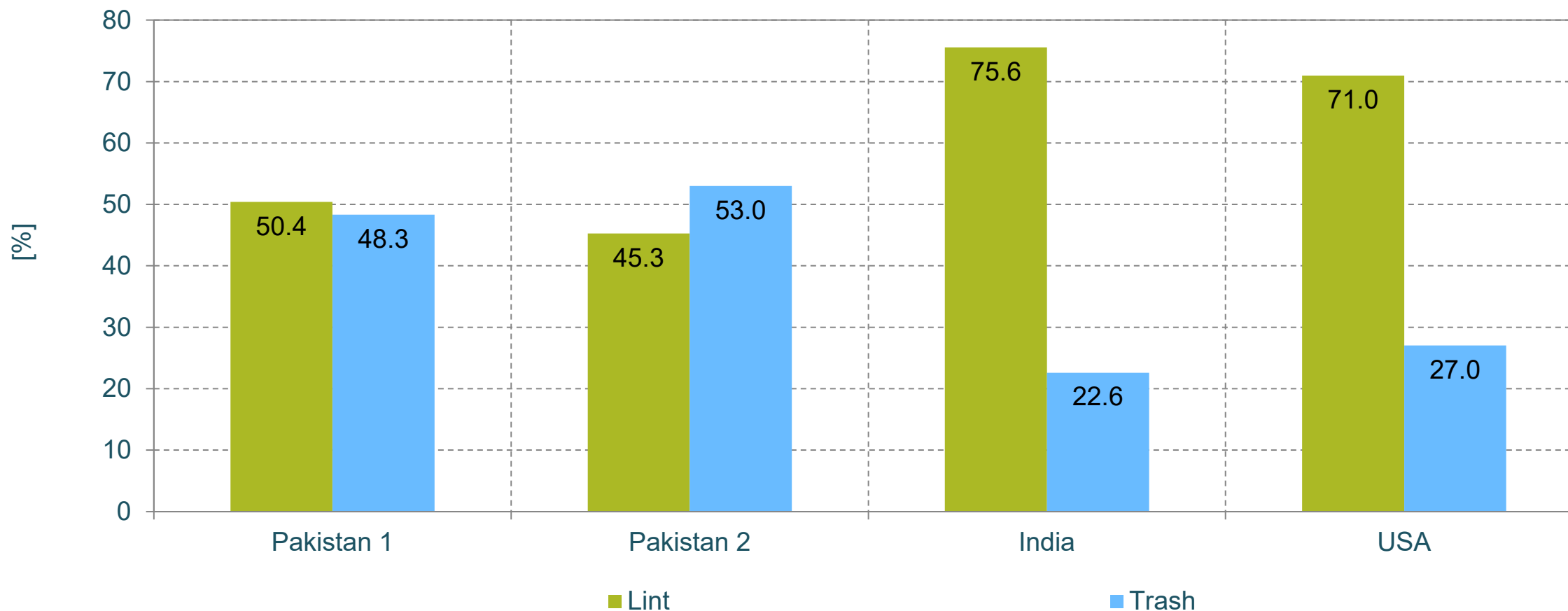


Waste card



Lint and Trash

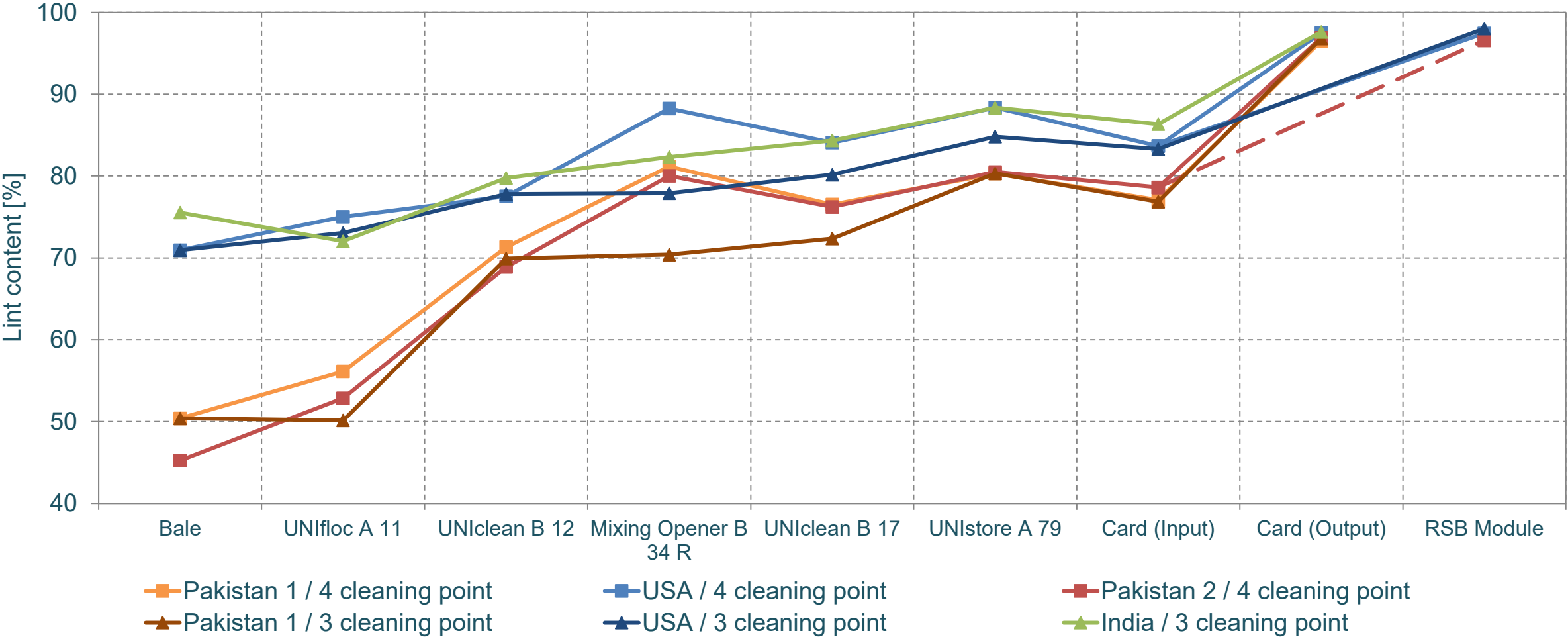
Lint and trash of various cotton by Shirley
100% Cotton blowroom / carding waste



Lint – Quantity



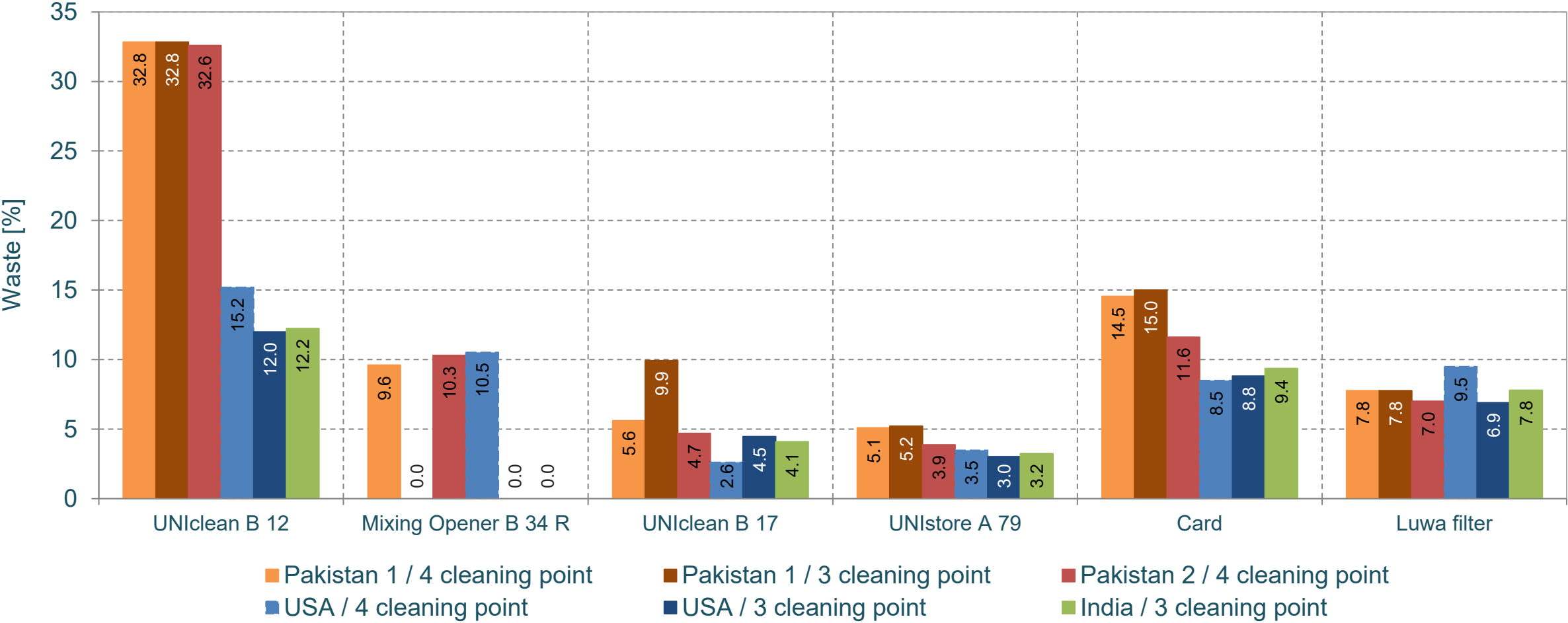
Lint content over process stages (Shirley)
100% Cotton blowroom / carding waste



Waste, Lint, Trash – Quantity



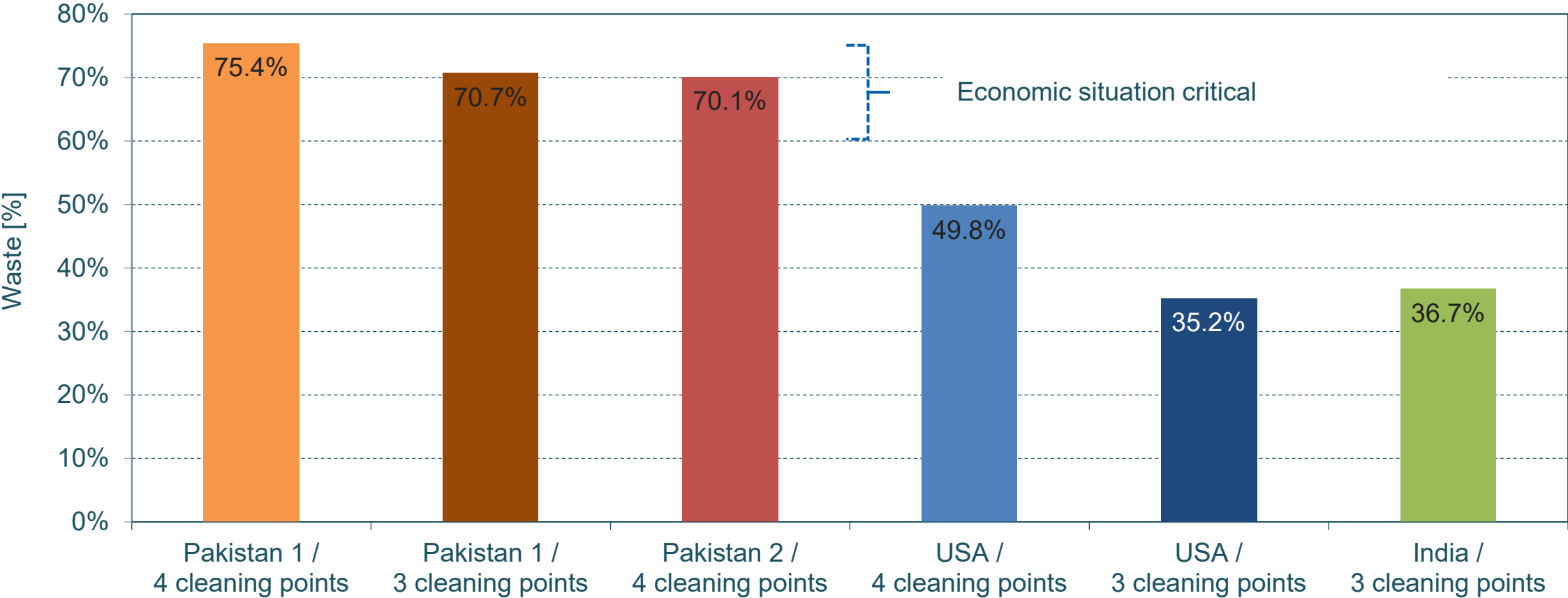
Waste amount over process stages
100% Cotton blowroom / carding waste



Waste, Lint, Trash – Quantity



Waste amount using different cotton blowroom / carding waste



Waste, Lint, Trash – Quantity

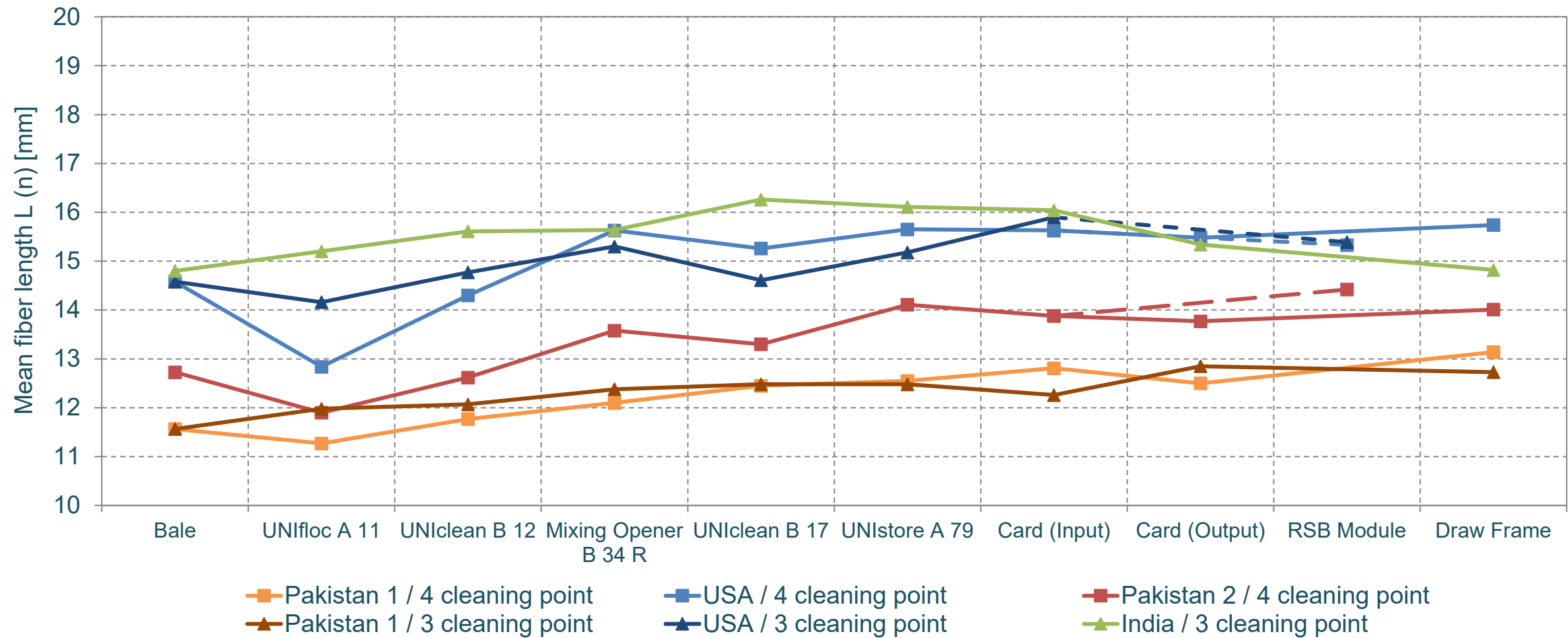


Criteria	Pakistan	India	USA
Lint	45 – 50%	75%	70%
	After the carding process the lint is about 96-97%		
Trash	48 – 53%	23%	27%
	Best cleaning performance with coarse cleaner B 12 Second best is card C 70		
Waste	70 – 75%	36.7%	35 – 50%
	The higher the amount of waste the lower the economic viability		

Fiber Quality



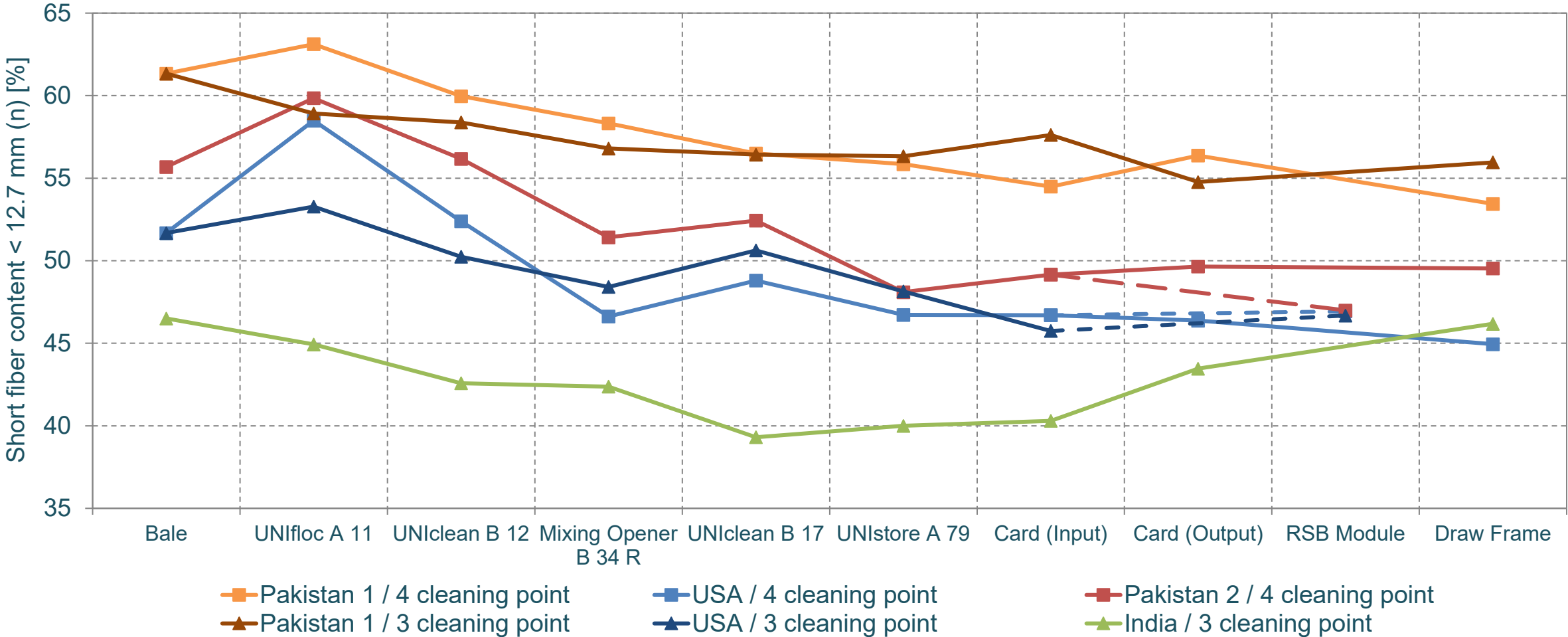
Fiber length over process stages (AFIS)
100% Cotton blowroom / carding waste



Fiber Quality



Fiber length over process stages (AFIS)
100% Cotton blowroom / carding waste



Fiber Length - Quantity

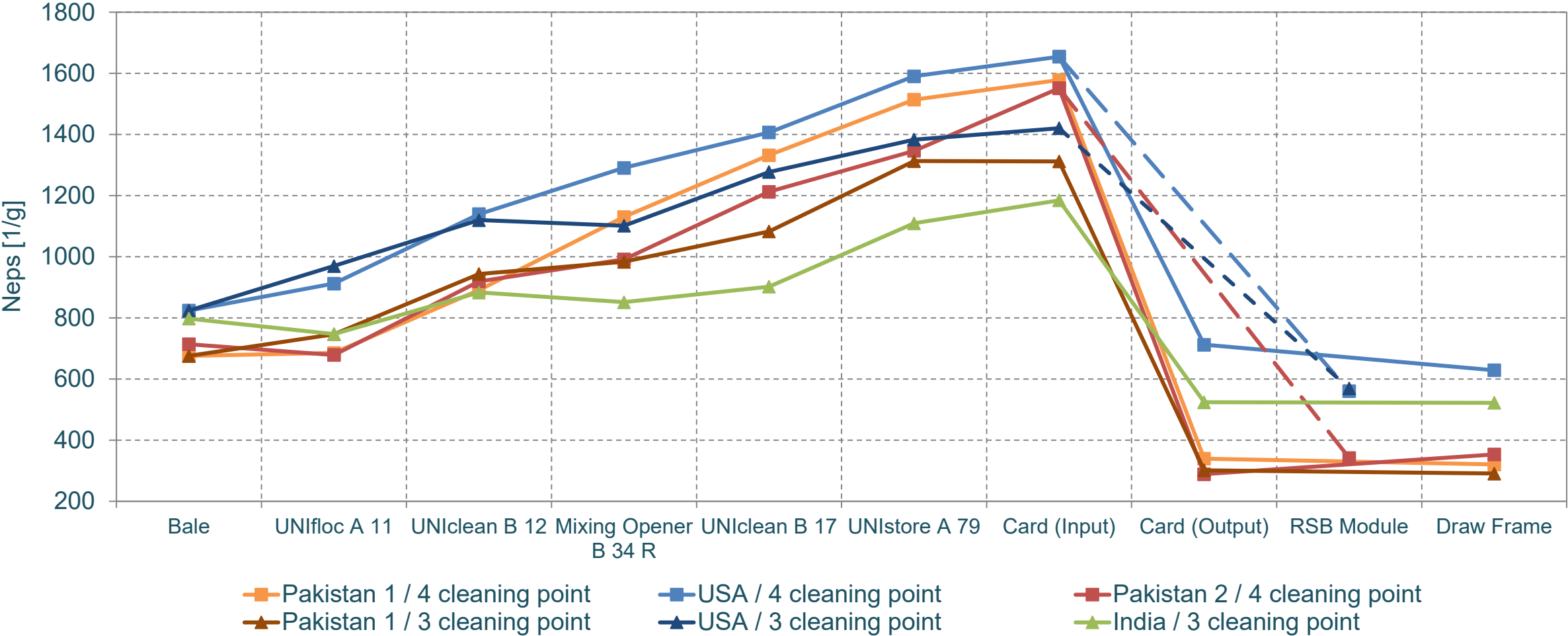


Criteria	Pakistan	India	USA
Commercial length UQL [mm]	24 – 26	26 – 27	29 – 30
5% length [mm]	28 – 29	30 – 32	34 – 35
	Cleaning machine shows no influence on fiber stress. Card shortens the fibers about 1 mm.		
Middle length [mm]	12 – 14	15	14.5 – 15.5
	Fiber stress of carding of about 1 mm		
Short-fiber content [mm]	50 – 55%	45%	45%
	Poor prognosis for ring spinning		

Fiber Quality



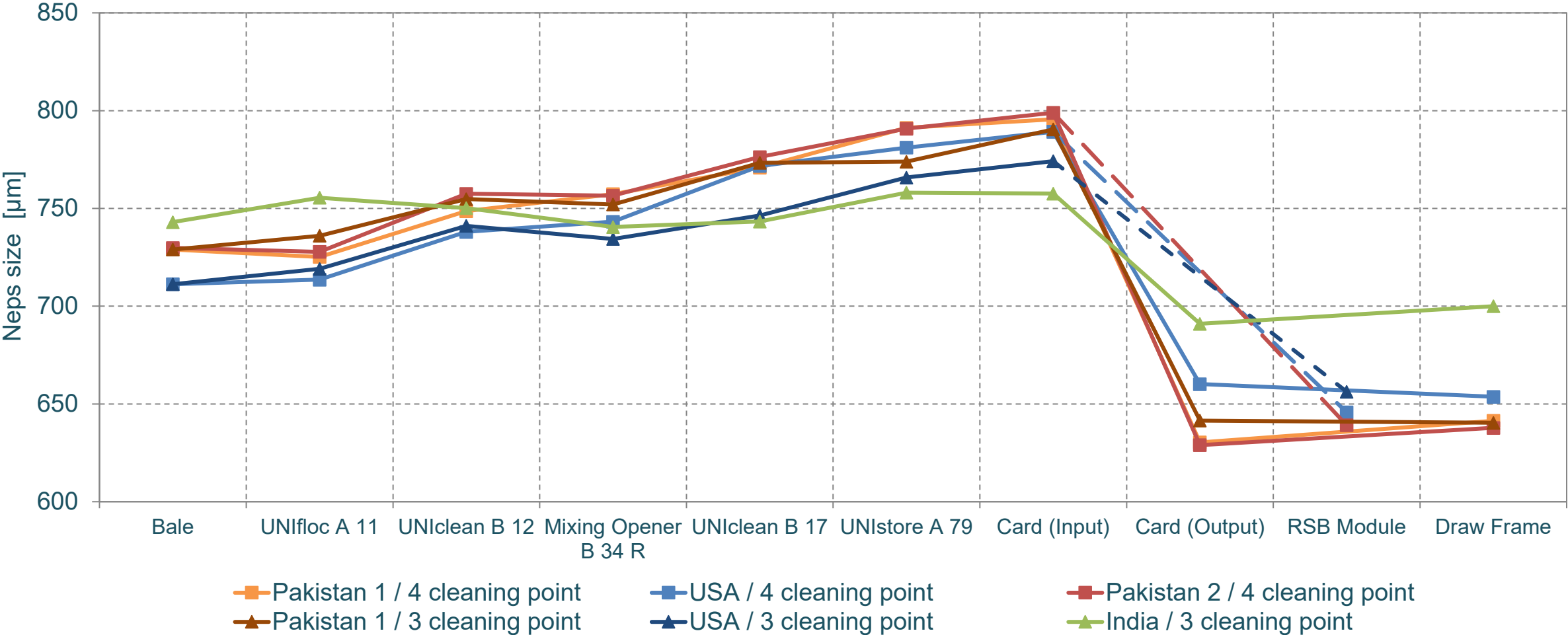
Neps over process stages (AFIS)
100% Cotton blowroom / carding waste



Fiber Quality



Neps size over process stages (AFIS)
100% Cotton blowroom / carding waste



Fiber Neps and Stress



Criteria	Pakistan	India	USA
Neps [1/g]	More neps after the cleaning machine		
Nep size [mm]	With 0.63 - 0.7 mm more as the yarn diameter from 0.3 - 05		
Strength [g/tex]	28	28	38
	No strength loss over the process steps		
Elongation [%]	5.5 - 6.5	6.5	7.5
	Fiber stress and elongation loss in the card		

03

Yarn Quality

Position Description - Rotor

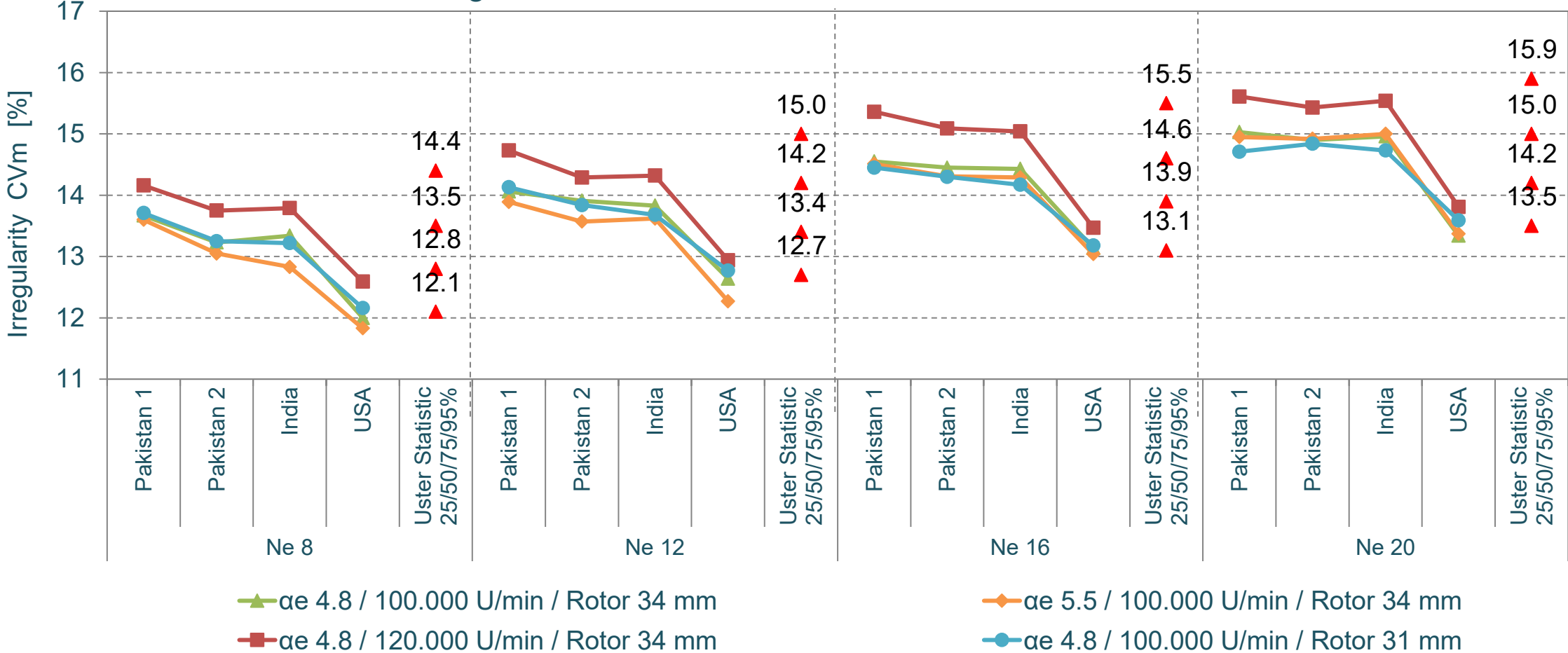


Criteria	Pakistan 1	Pakistan 2	India	USA
Cleaning points	4	4	3	4

Yarn Quality - Rotor



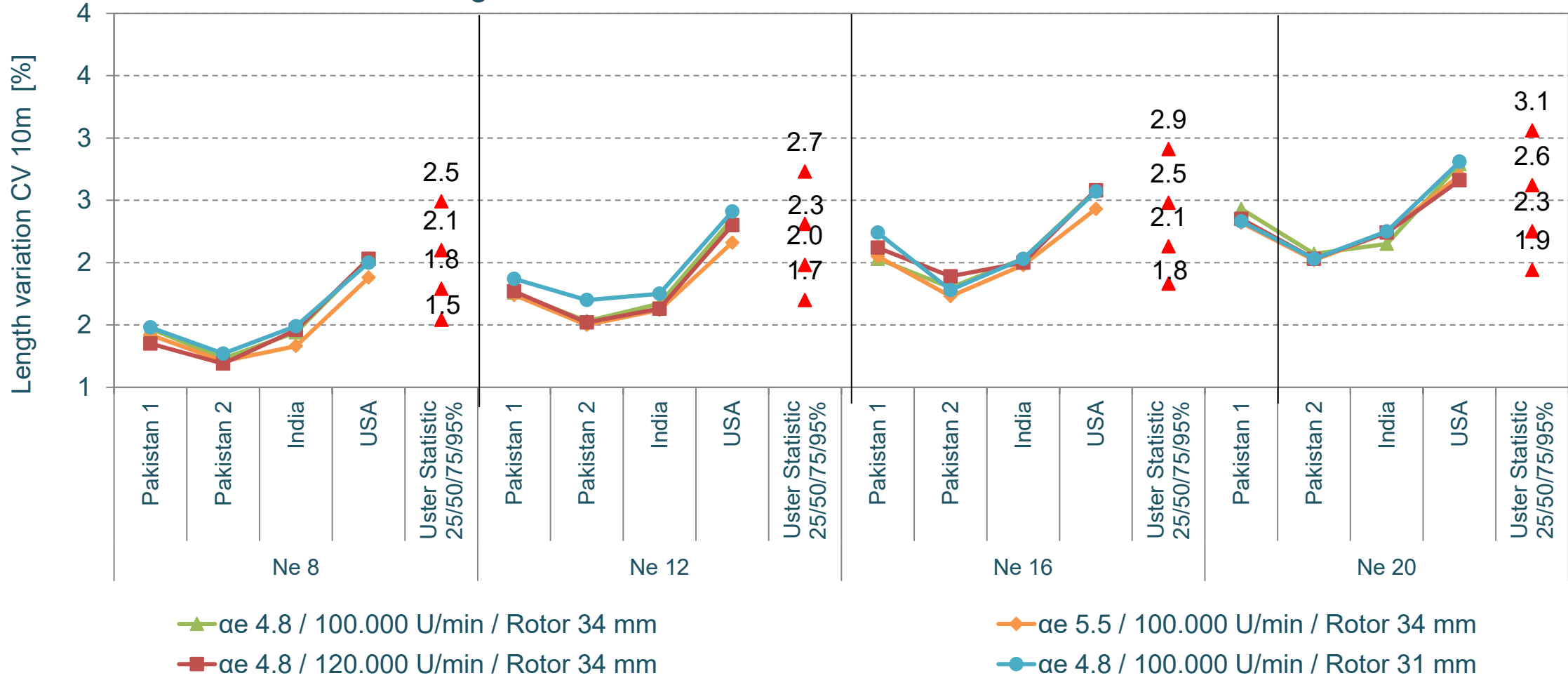
Irregularity of rotor yarn versus raw material
100% Cotton blowroom / carding waste



Yarn Quality - Rotor



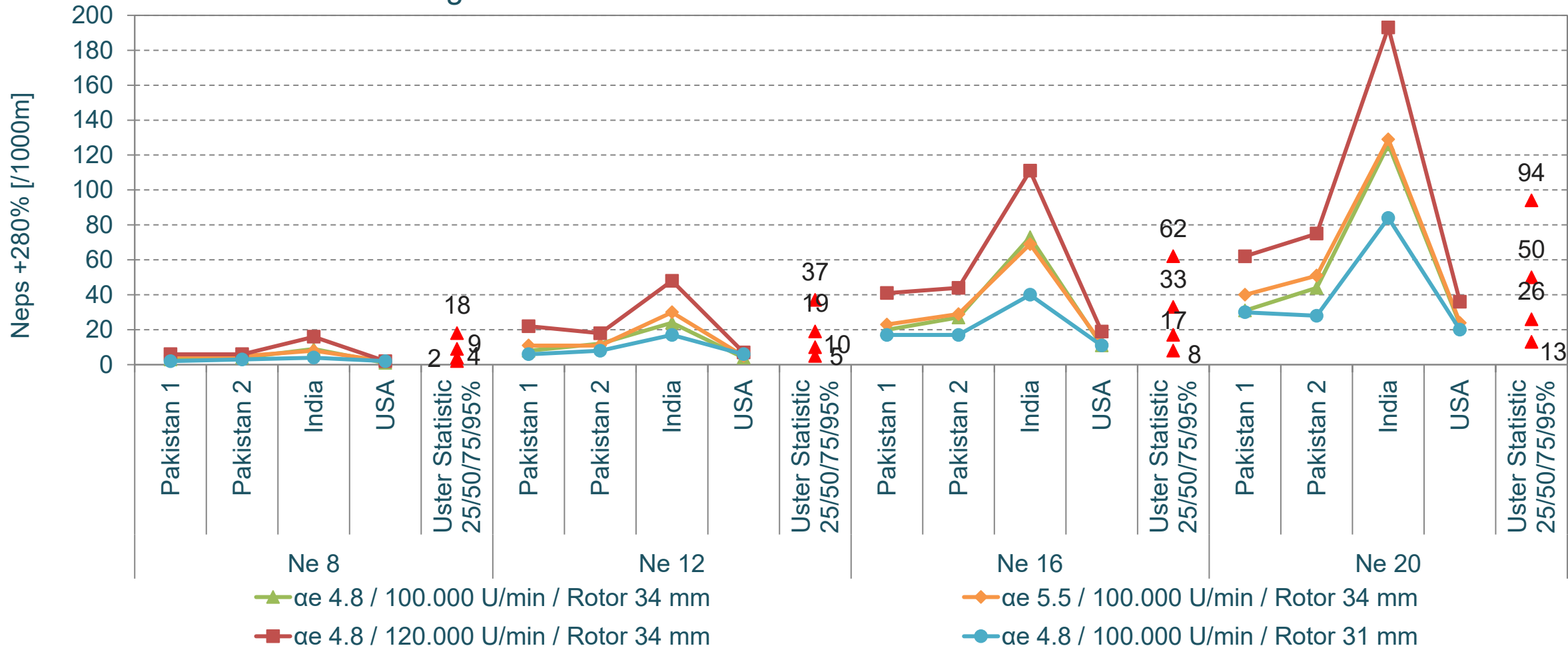
Length variation of rotor yarn versus raw material
100% Cotton blowroom / carding waste



Yarn Quality - Rotor



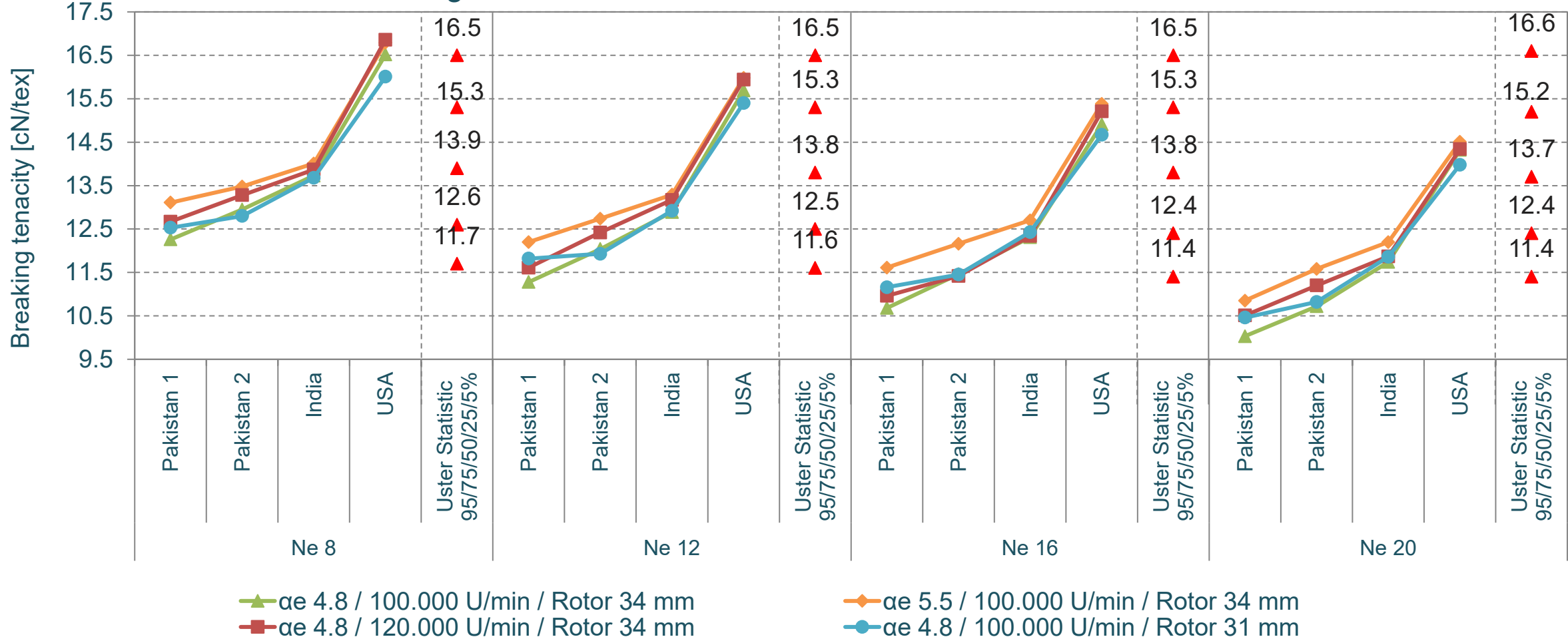
Neps of rotor yarn versus raw material
100% Cotton blowroom / carding waste



Yarn Quality - Rotor



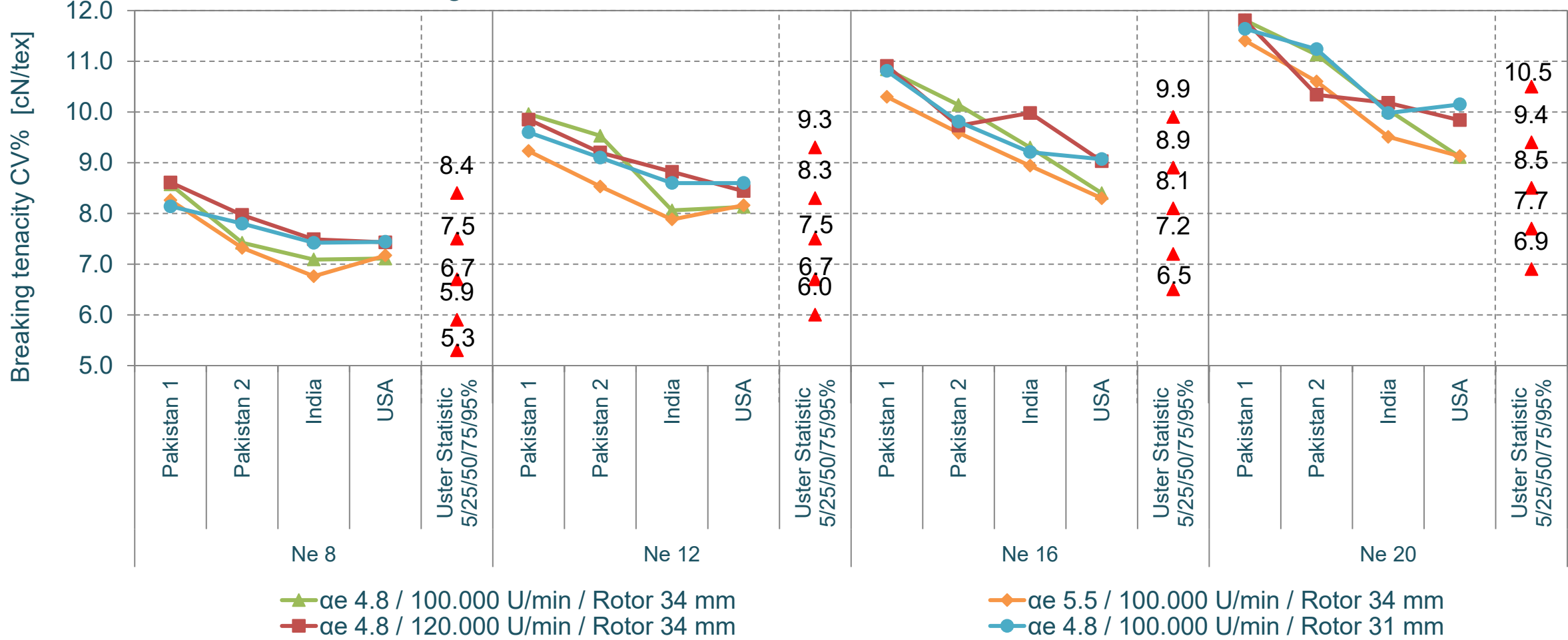
Breaking tenacity of rotor yarn versus raw material
100% Cotton blowroom / carding waste



Yarn Quality - Rotor



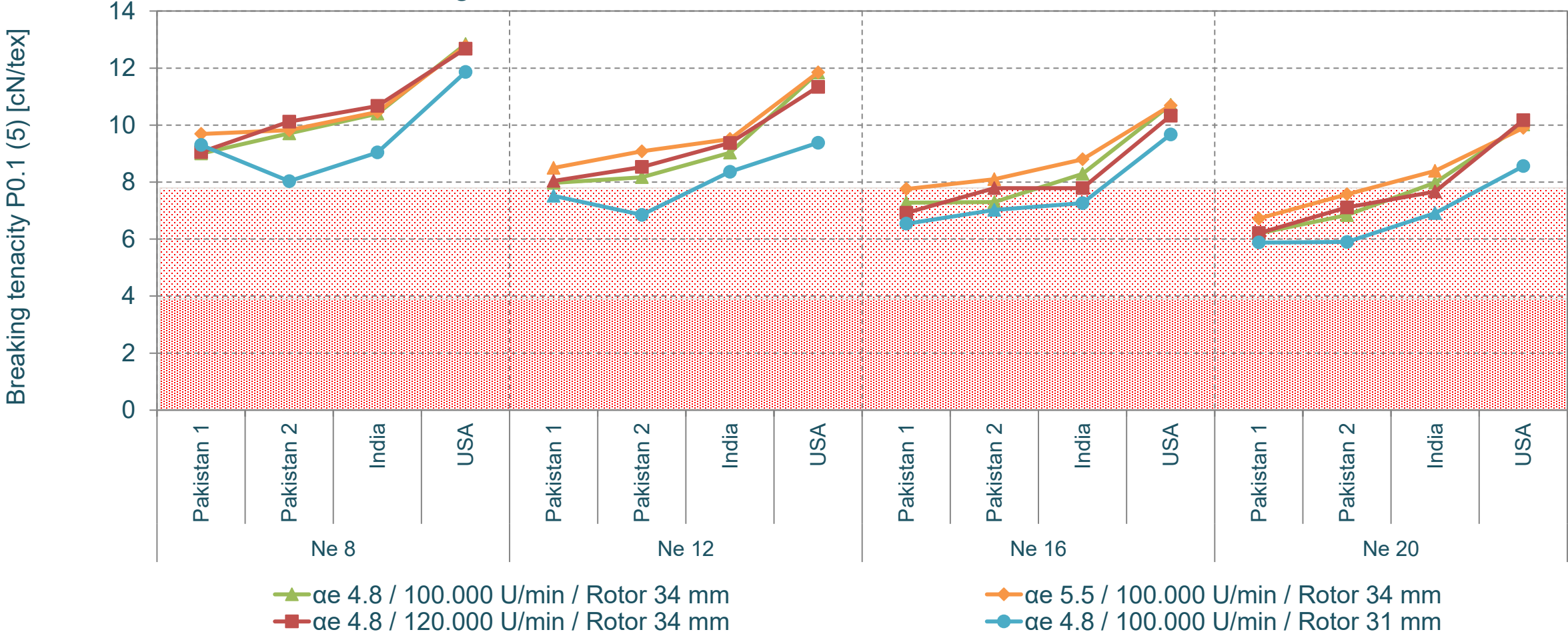
Breaking tenacity CV of rotor yarn versus raw material
100% Cotton blowroom / carding waste



Yarn Quality - Rotor



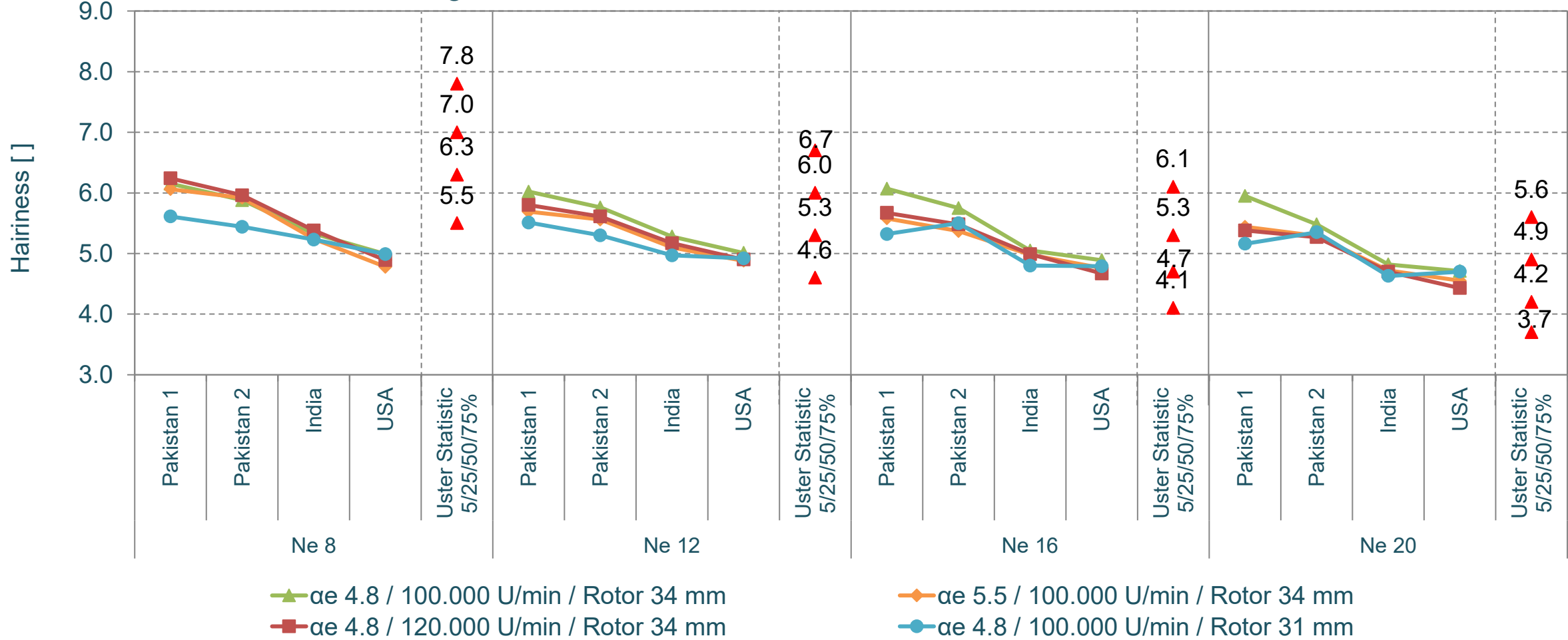
Tenacity percentile of rotor yarn versus raw material
100 % Cotton blowroom / carding waste



Yarn Quality - Rotor



Hairiness of rotor yarn versus raw material
100% Cotton blowroom / carding waste

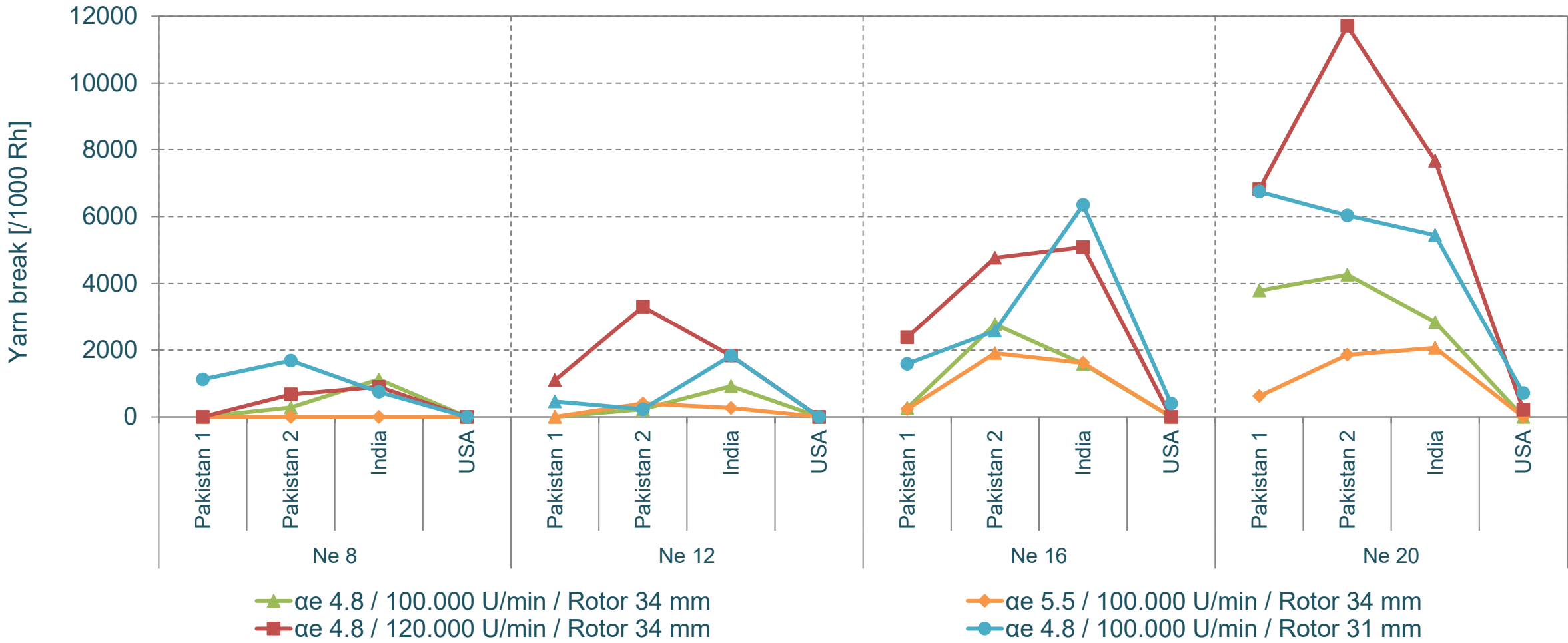


Yarn Quality - Rotor



Yarn breaks on rotor versus raw material

100 % Cotton blowroom / carding waste



Rotor Yarn Quality

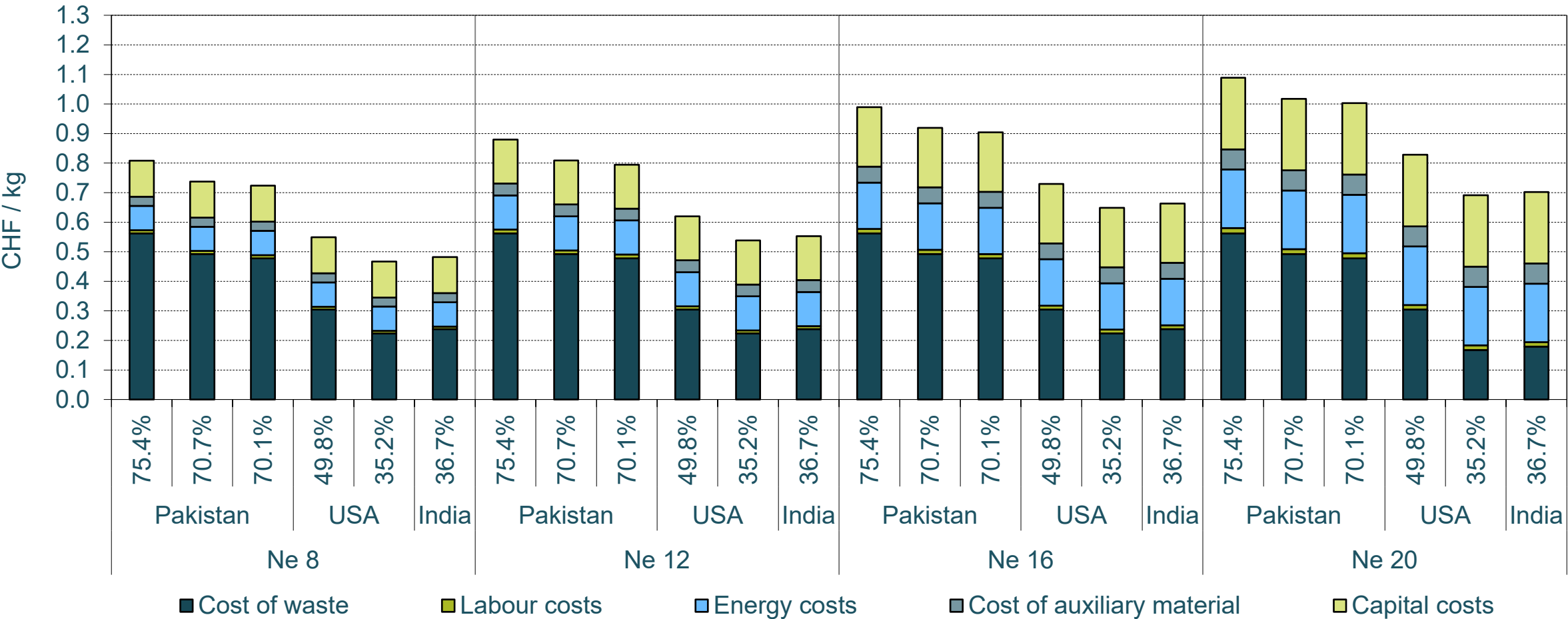


Criteria	Pakistan	India	USA
Unevenness CVm	Raw material has the same big influence as yarn count. The following parameters also have an influence: • Rotor speed max. = 100 000 U/min • Rotor diameter = 31 – 34 mm • Twist factor (αe) = 4.8 – 5.5		
Unevenness CV 10m	good	good	worse than the others
Neps	Smaller rotor with 31 mm has a positive influence on neps		
Strength	lowest		highest
	Bigger rotor with 34 mm has a positive influence on strength		
Strength Weak point	max. Ne 8	max. Ne 12	max. Ne 20

04

Economy

Yarn manufacturing cost comparison
100 % Waste cotton carded



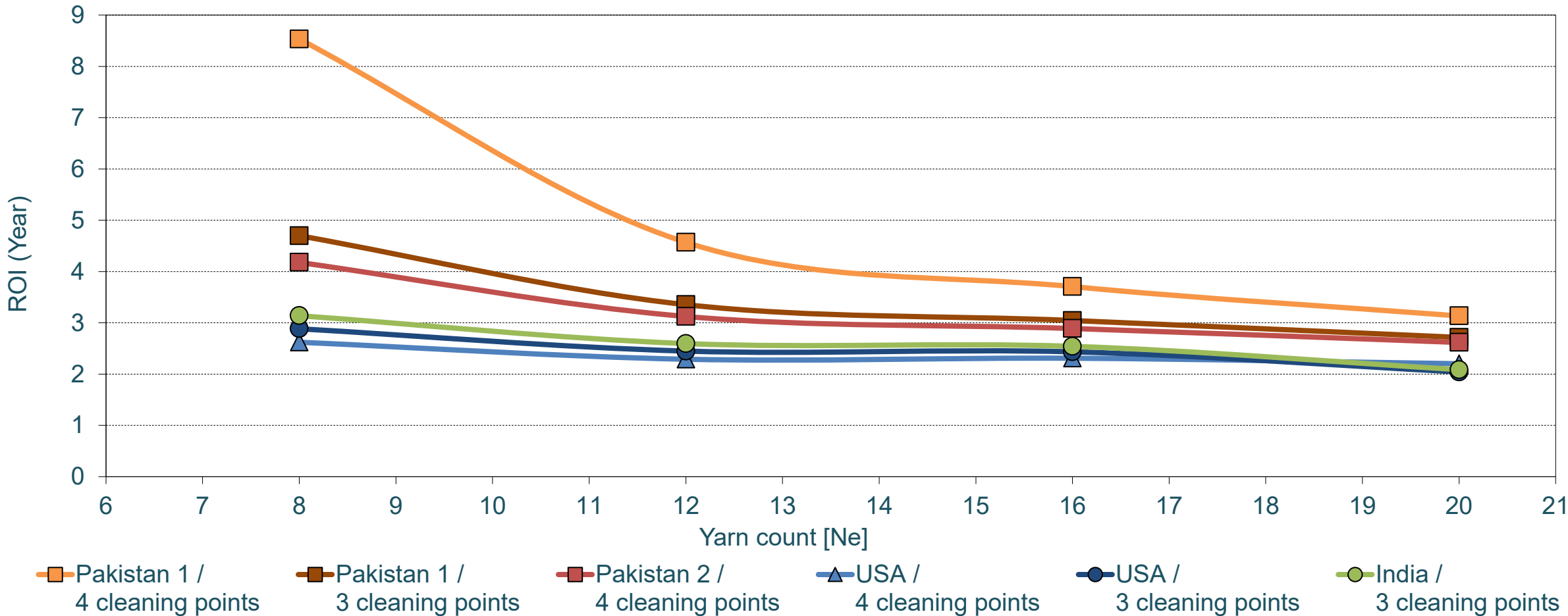
Economy



100% waste cotton carded

Raw material type	Pakistan 1	Pakistan 1	Pakistan 2	USA	USA	India
Cleaning points	4	3	4	4	3	3
Max. raw material price (CHF/kg)	0.18	0.2	0.2	0.3	0.4	0.4
Yarn count [Ne]	8	12	16	20		
Min. required yarn price (CHF/kg)	1.05	1.2	1.4	1.6		

Return of investment calculation (ROI)
100 % Waste cotton carded



05

Summary

Summary

Findings raw material and cleaning

- Min. 55% lint content in the bale.
- Max. 70% waste from all process stages.
- Lint content after card = independent from raw material 97%.
Technical or technological possible to get the lint out in any case, but it is a question of economic ROI.
- Spinning waste “India” and “USA” has highest prospects of success regarding quality and economy.
- Amount of cleaning points (3 or 4) is important for the lifetime of carding wire and also influences the ROI.

Summary

Findings rotor spinning

Due to the short-fiber content and middle staple the following spin limit was reached:

- Pakistan max. Ne 8
- India max. Ne 12
- USA max. Ne 20
- Rotor speed max. = 100 000 U/min
- Rotor diameter 31 mm for lowest number of neps
 34 mm for highest strength
- Twist coefficient 5.5
- Application weaving in weft

Summary

Findings ring spinning

- Short-fiber content and middle staple with Pakistan cotton too high.
- USA max. Ne 16 possible
- Application weaving in warp and weft possible
- Yarn spinning technology Practical more realistic for rotor because of
 - Yarn unevenness
 - Yarn hairiness
 - Economical reasons

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