Fibre Properties in Wool Manufacture

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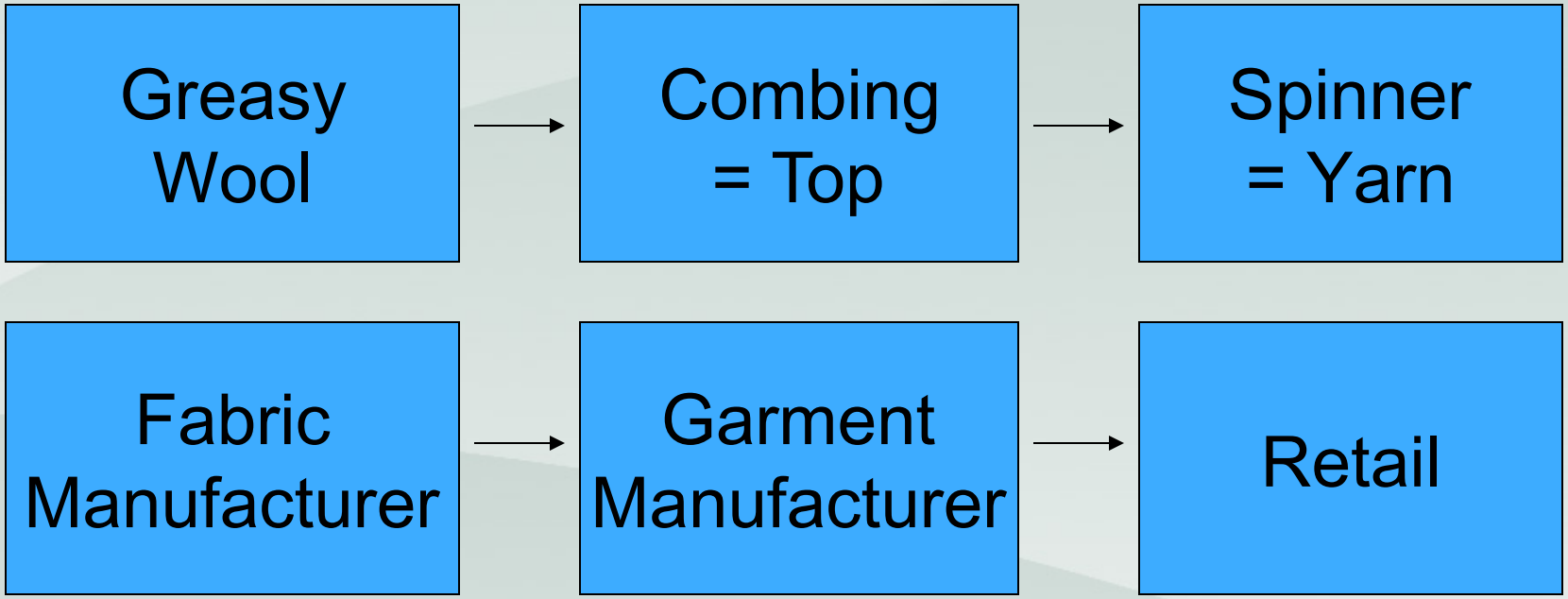
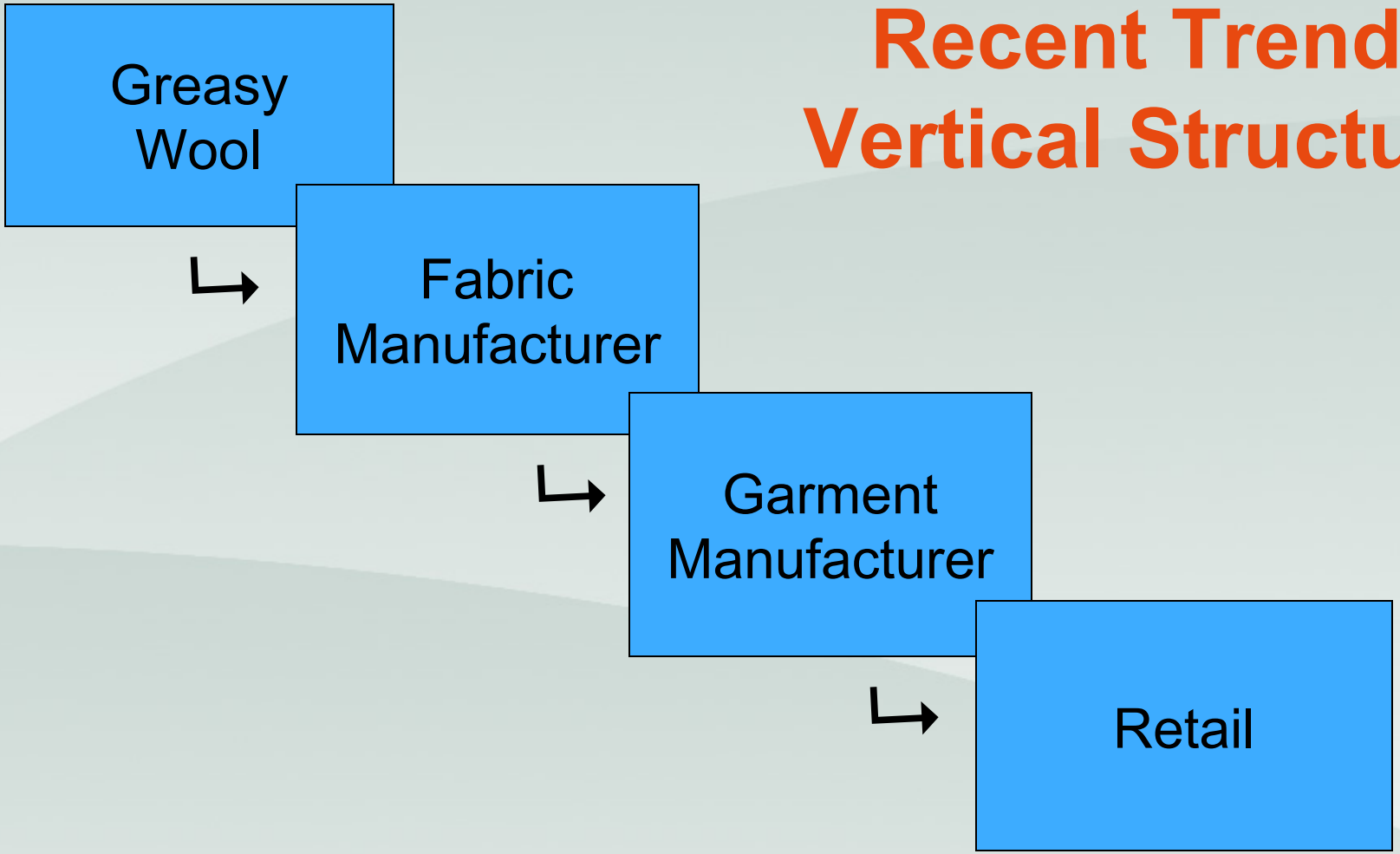
australian wool innovation limited

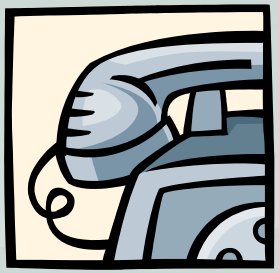
Traditional: Horizontal Structure

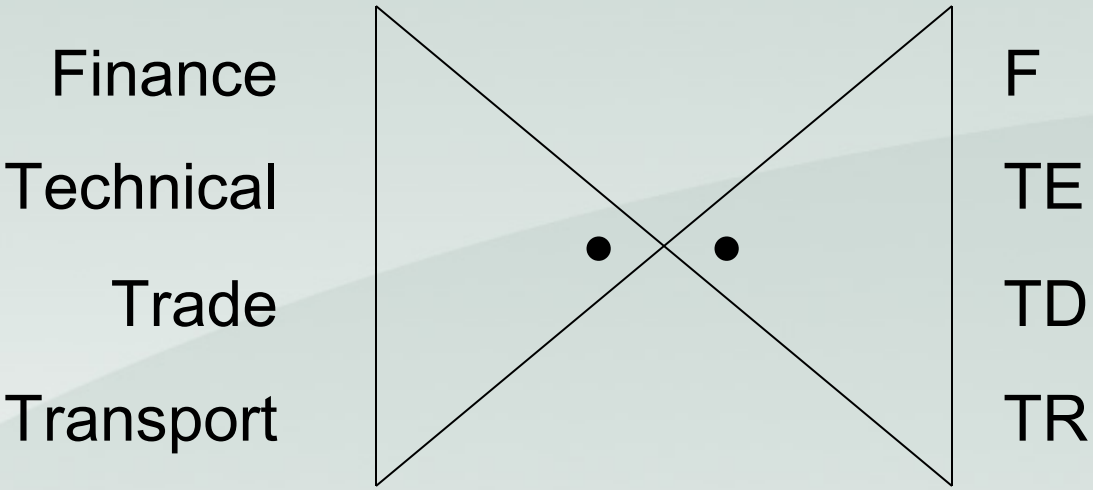


Recent Trend: Vertical Structure

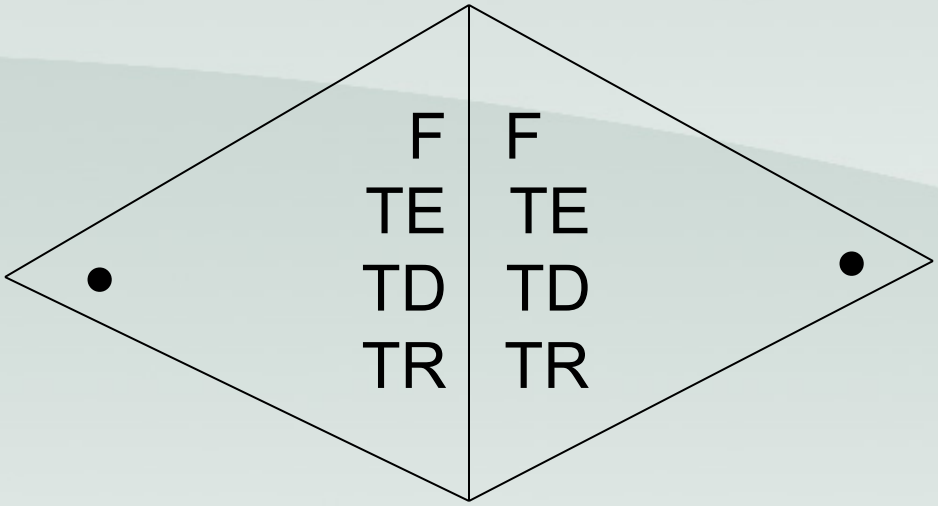


Communication Gates



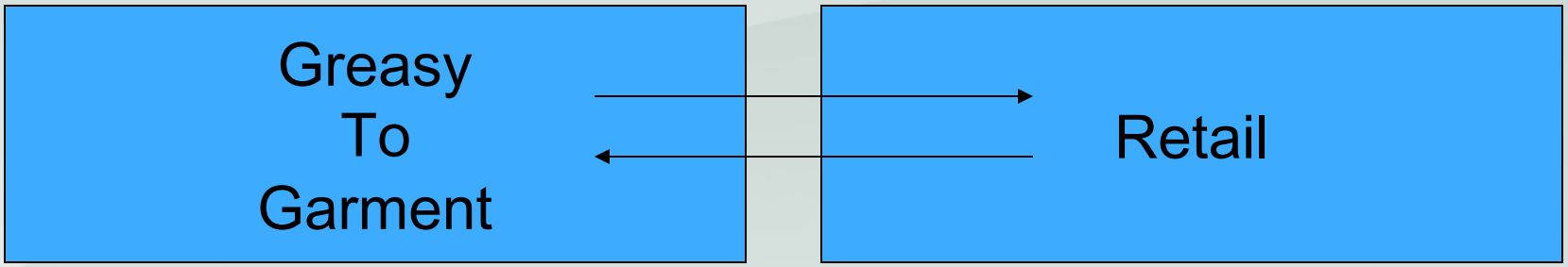


- Company Buyers



- Process Managers

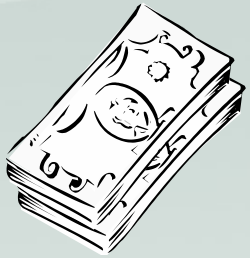
New?



Problem: Expertise in all areas

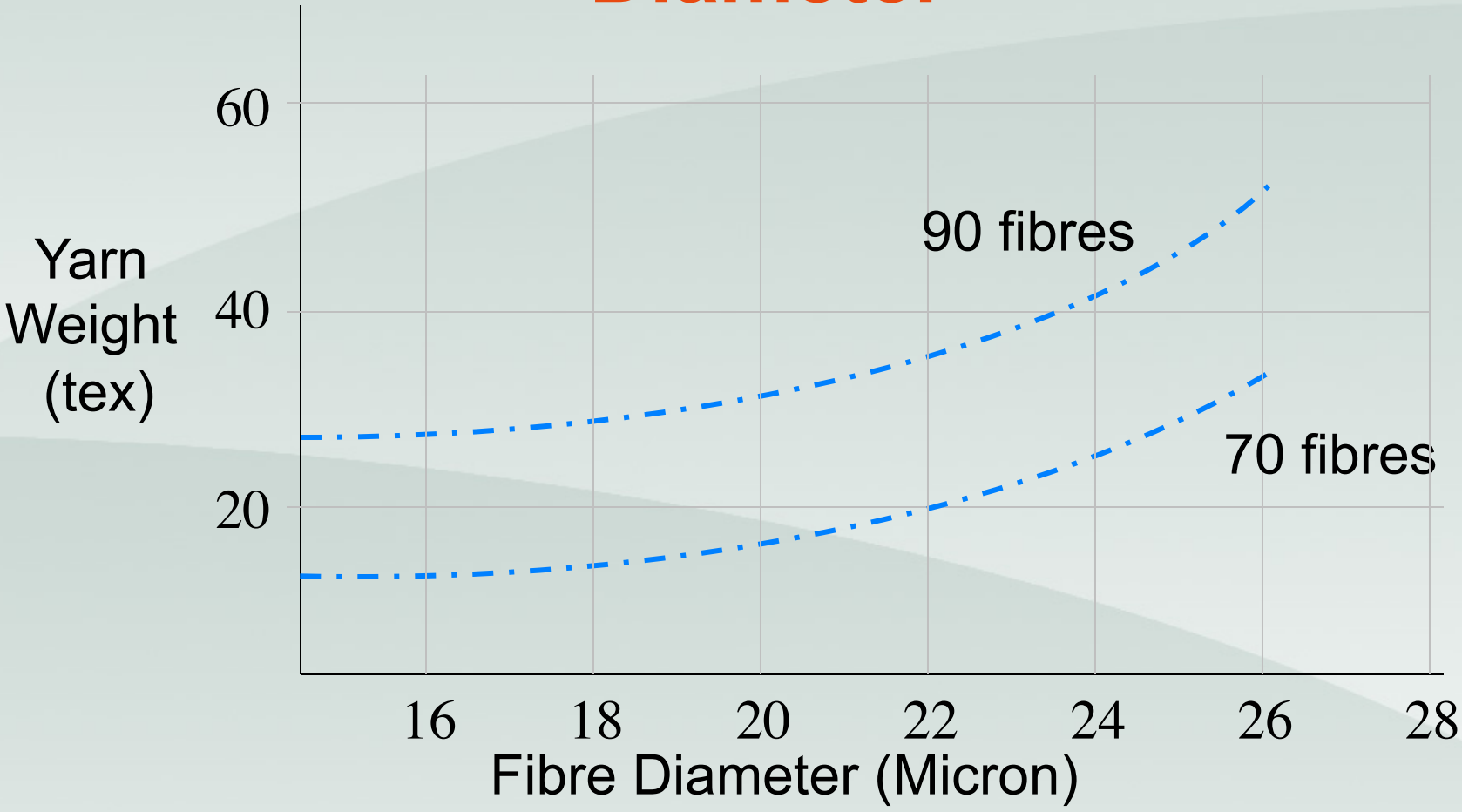
Solution: Communication (Managed Teams)

Fibre and Wool Growing

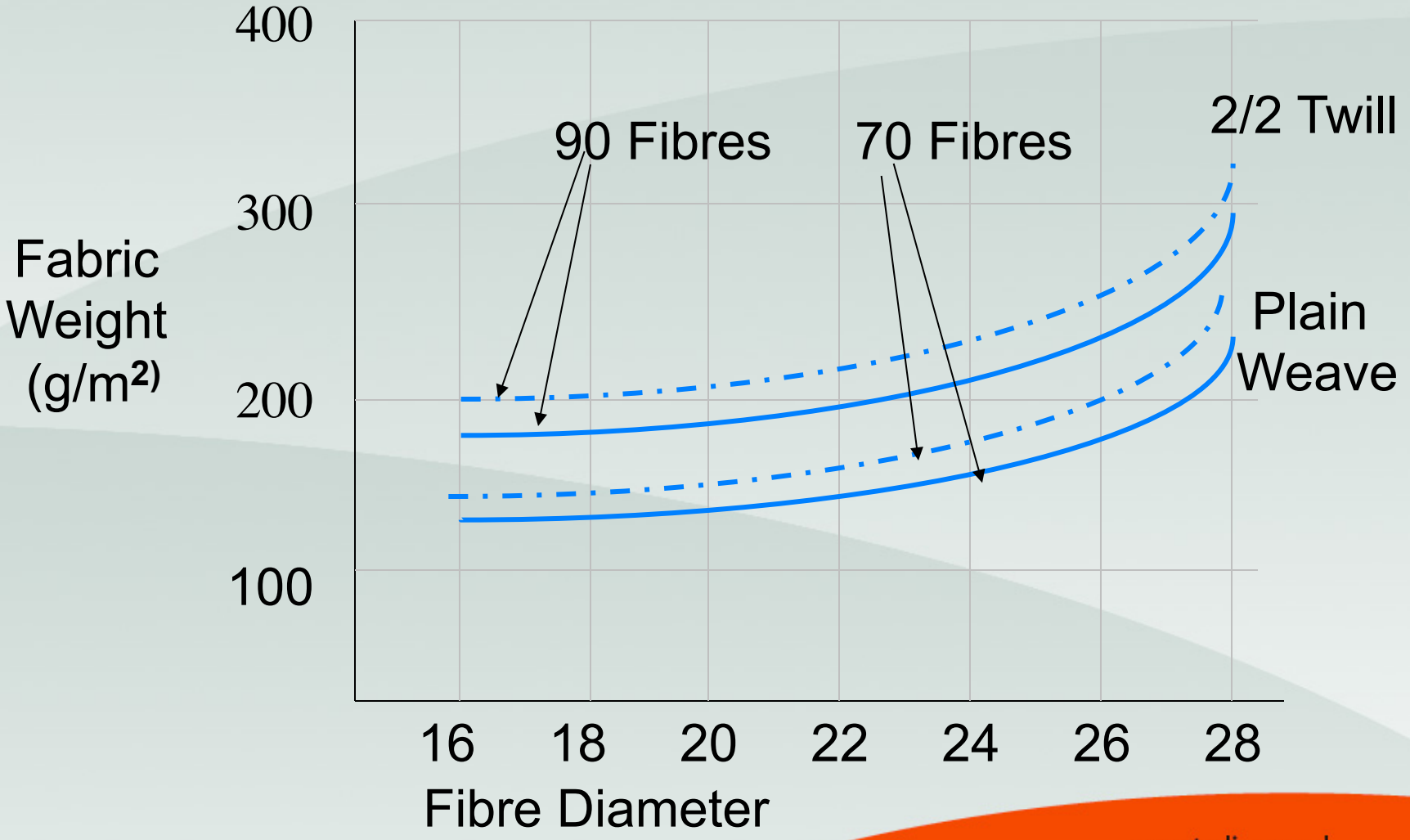
- Make Money 
- Finer Wool
- Increase Fleece Weight
  (Changes Crimp)

FIBRE DIAMETER

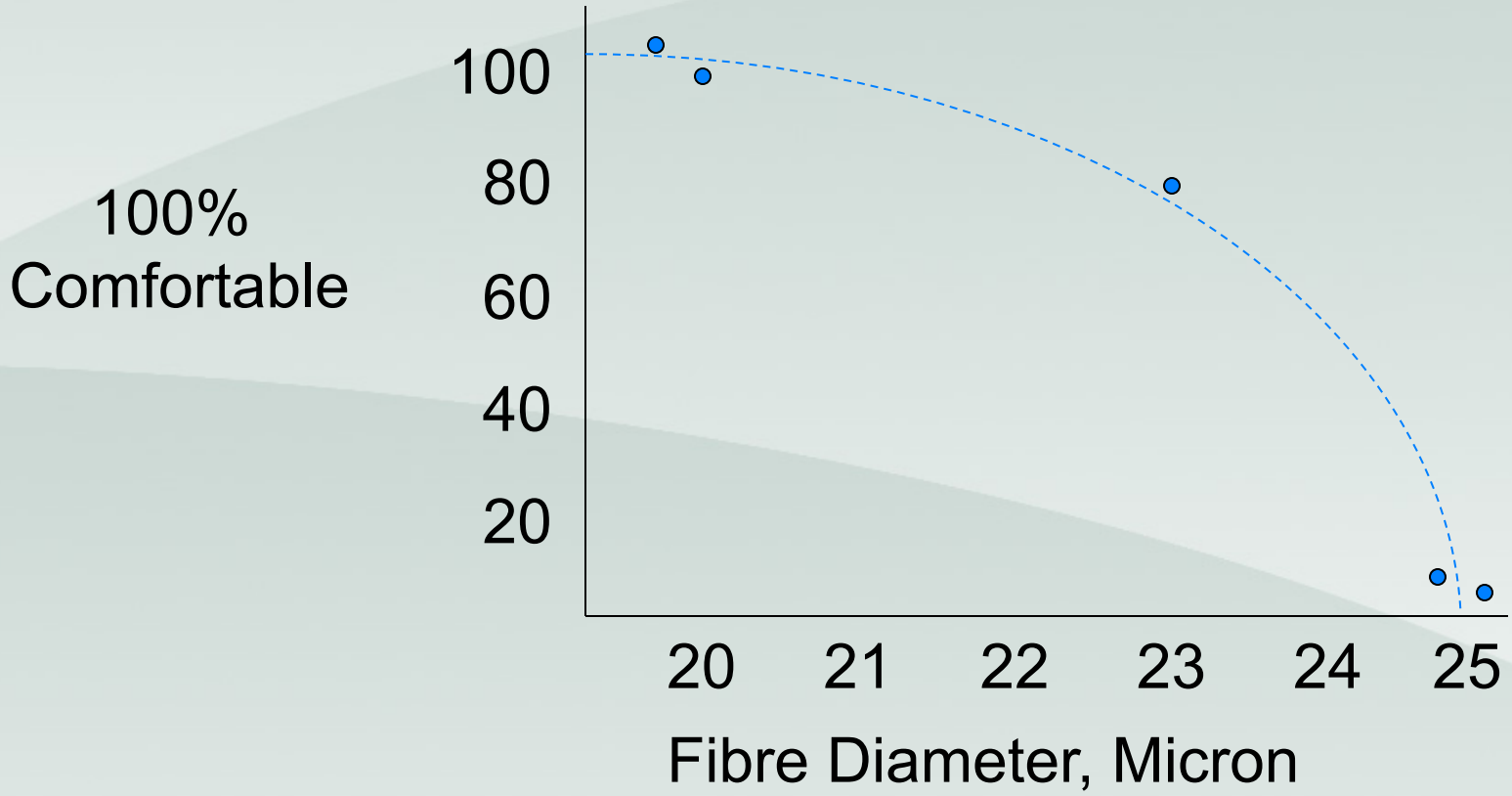
Yarn Linear Density, g/km, and Fibre Diameter



Fabric Weight, Fibre Diameter and Weave



Fibre Diameter and Comfort (Knitwear)



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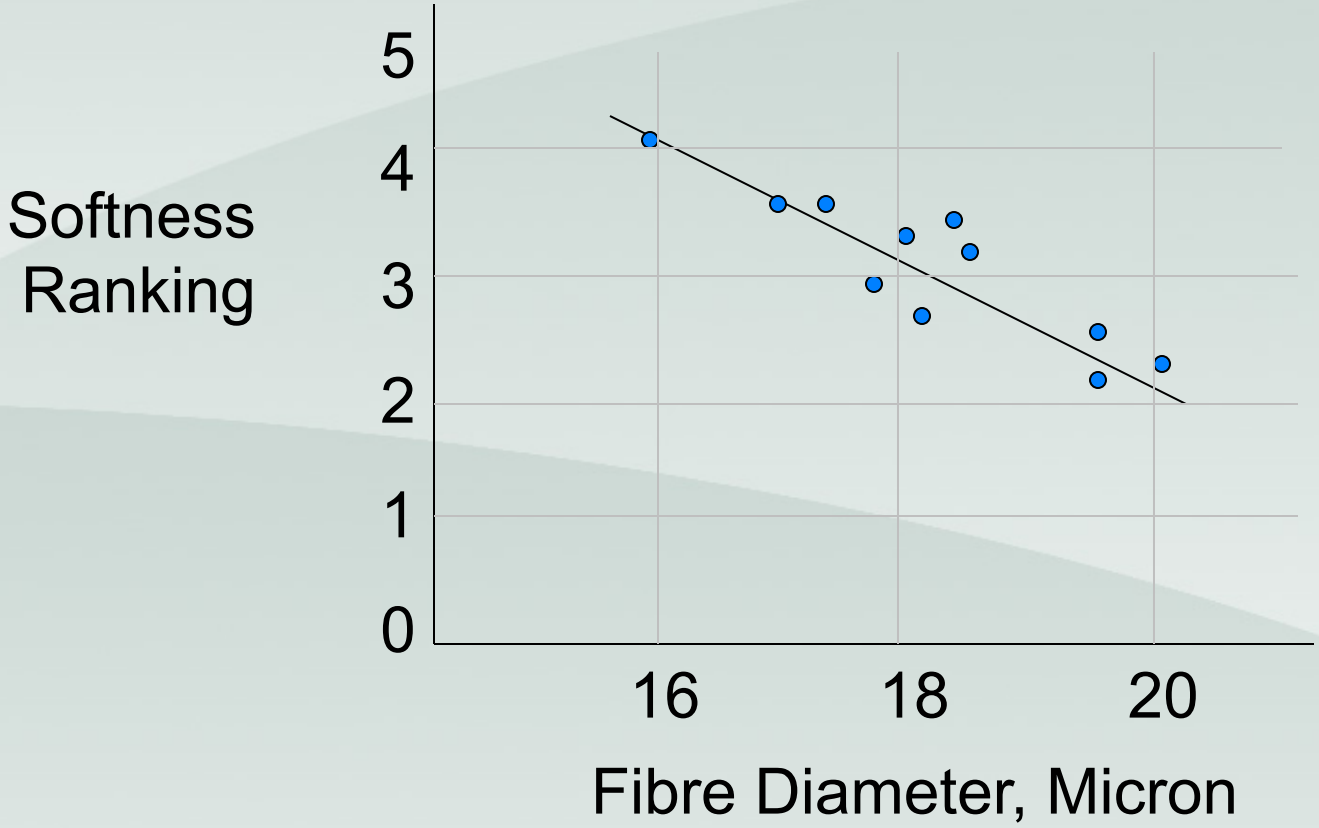


Coeff of Variation In Fibre Diameter CVD

- Smaller effect than Fibre Diameter

- Need a change of 6% in CVD

  = Small Change in Handle

Mean Fibre Diameter

- Significant effect on handle/softness
- Significant effect on fabric weight
- Effects process variations

FIBRE LENGTH

Fibre Length

Hauteur: Number x Cross-section

Equal Visual

Barbe: Weight-biased

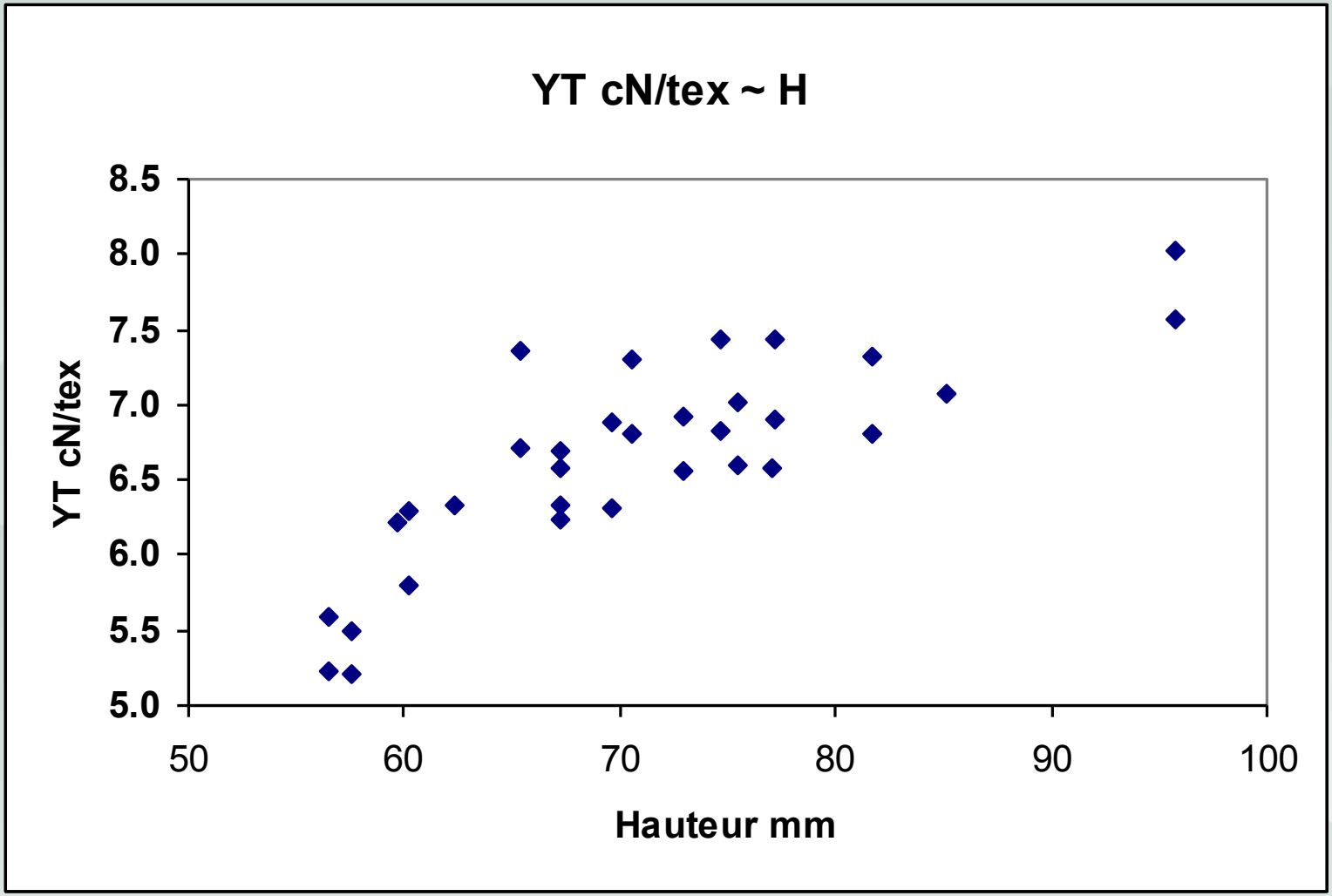
Distribution

Barbe is always greater than Hauteur

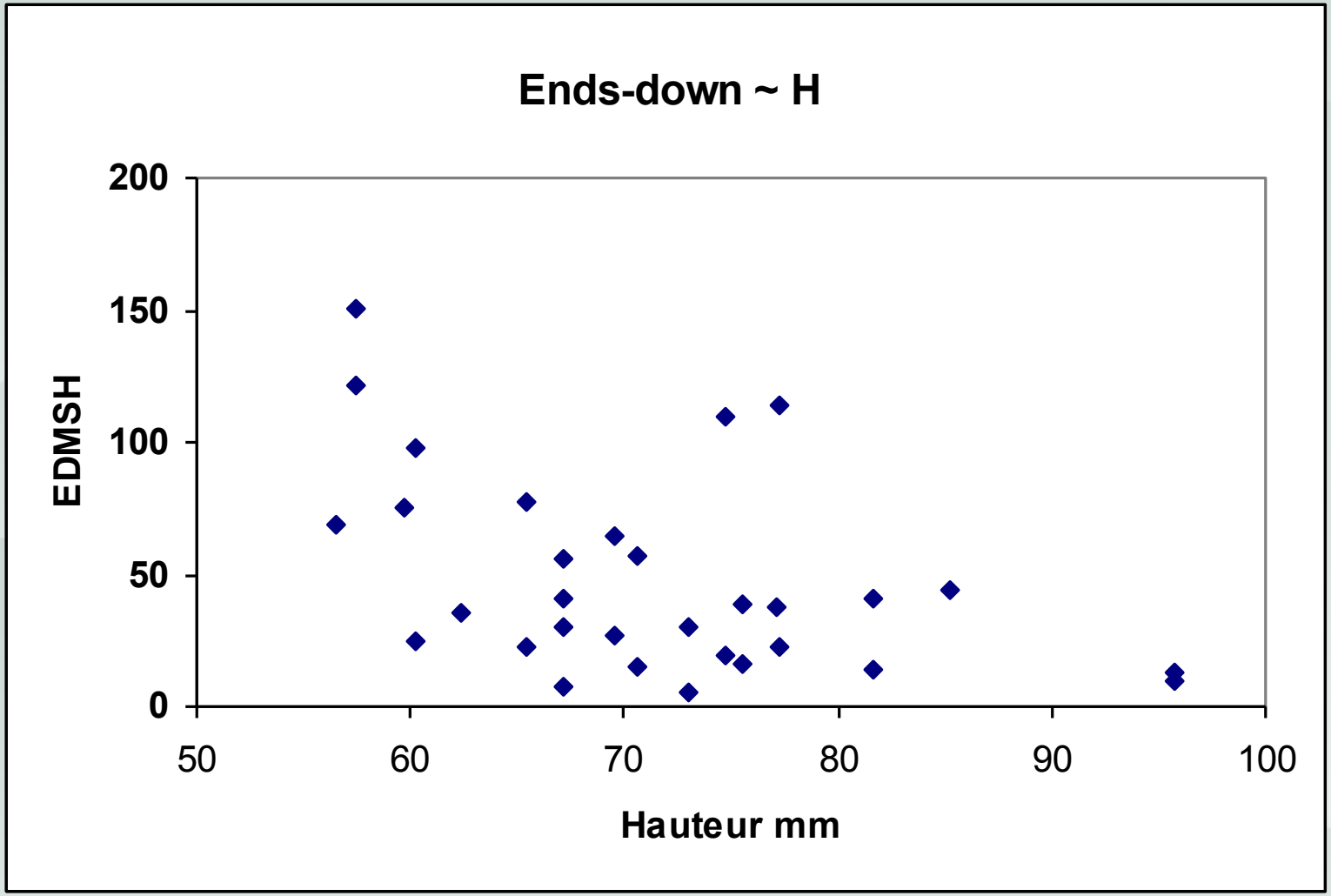
$$B = H (1 + V^2)$$

V = Fractional Coeff. Variation of Hauteur

Fibre Length and Yarn Tenacity



Fibre Length and Spinning



Mean Fibre Length - Hauteur

(ref - Toptech ’96)

- For yarn tenacity & ends down, 10mm = 1µm
- For yarn evenness, 25mm = 1µm
- For fabric handle – no trade-off

Savings

10mm of Hauteur can allow (approx.):

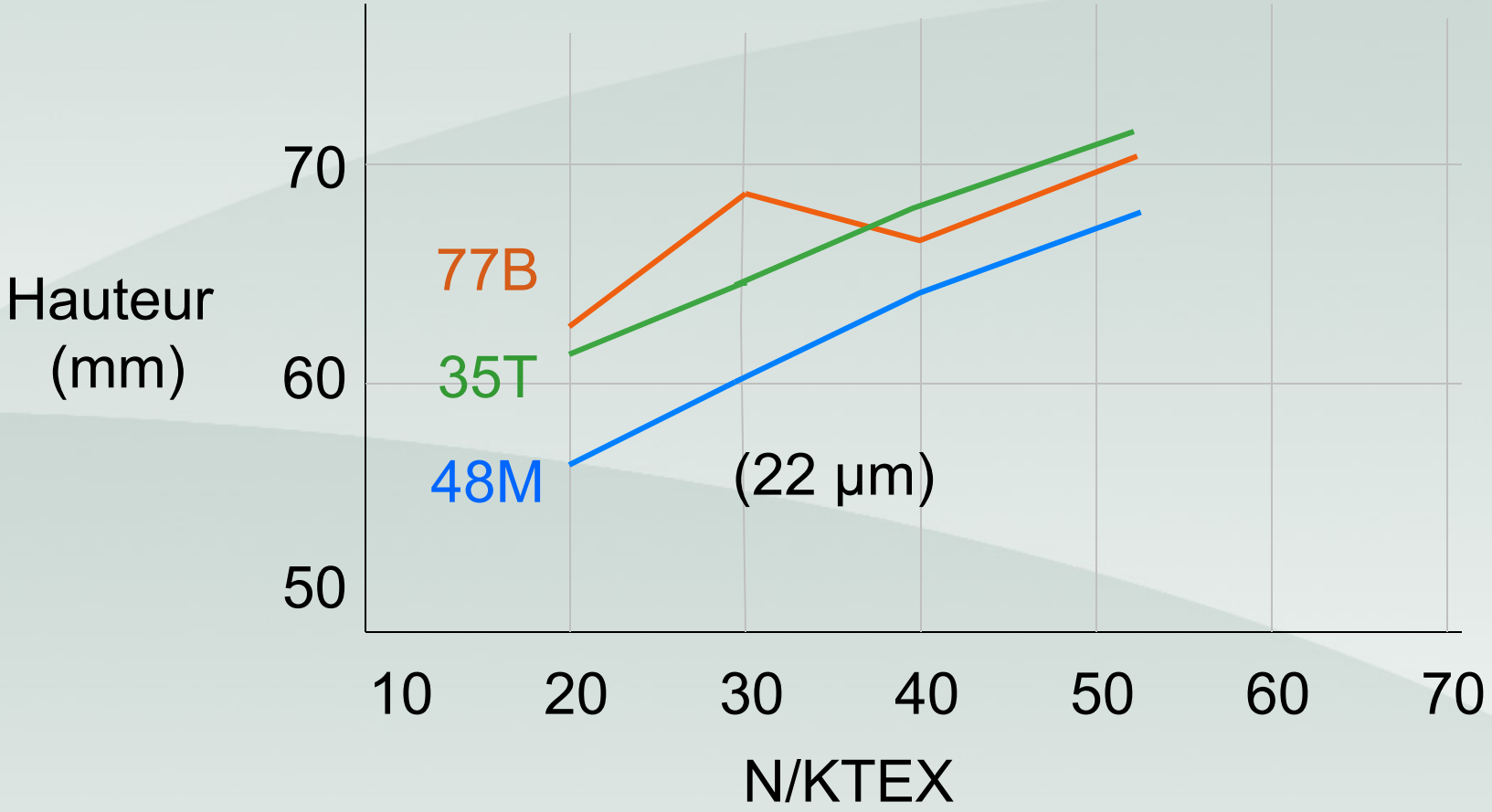
- a 10% reduction of twist, or
- a 7% increase of spinning speed, or
- a cheaper (1µm coarser) wool

Coeff. of Variation of Fibre Length

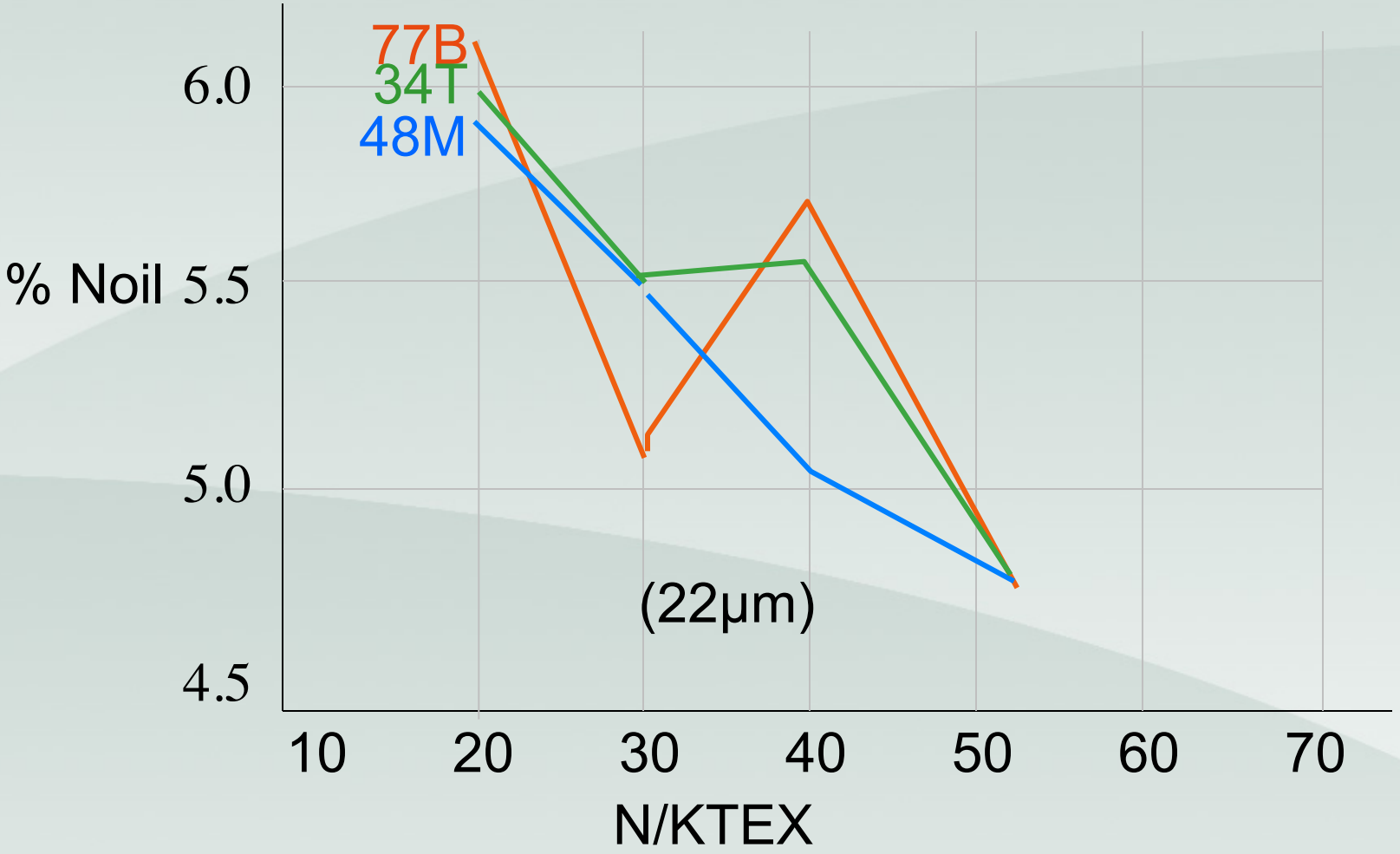
- Industry generally claims CV(H) is very important
- Longer staple length and lower strength gives a high CV(H). As does blending a wide range of fibre lengths
- Shorter staples give less breakage
- Controlled industry trials reveal it is the shorter H not the high CV(H) that matters

STAPLE STRENGTH and POB

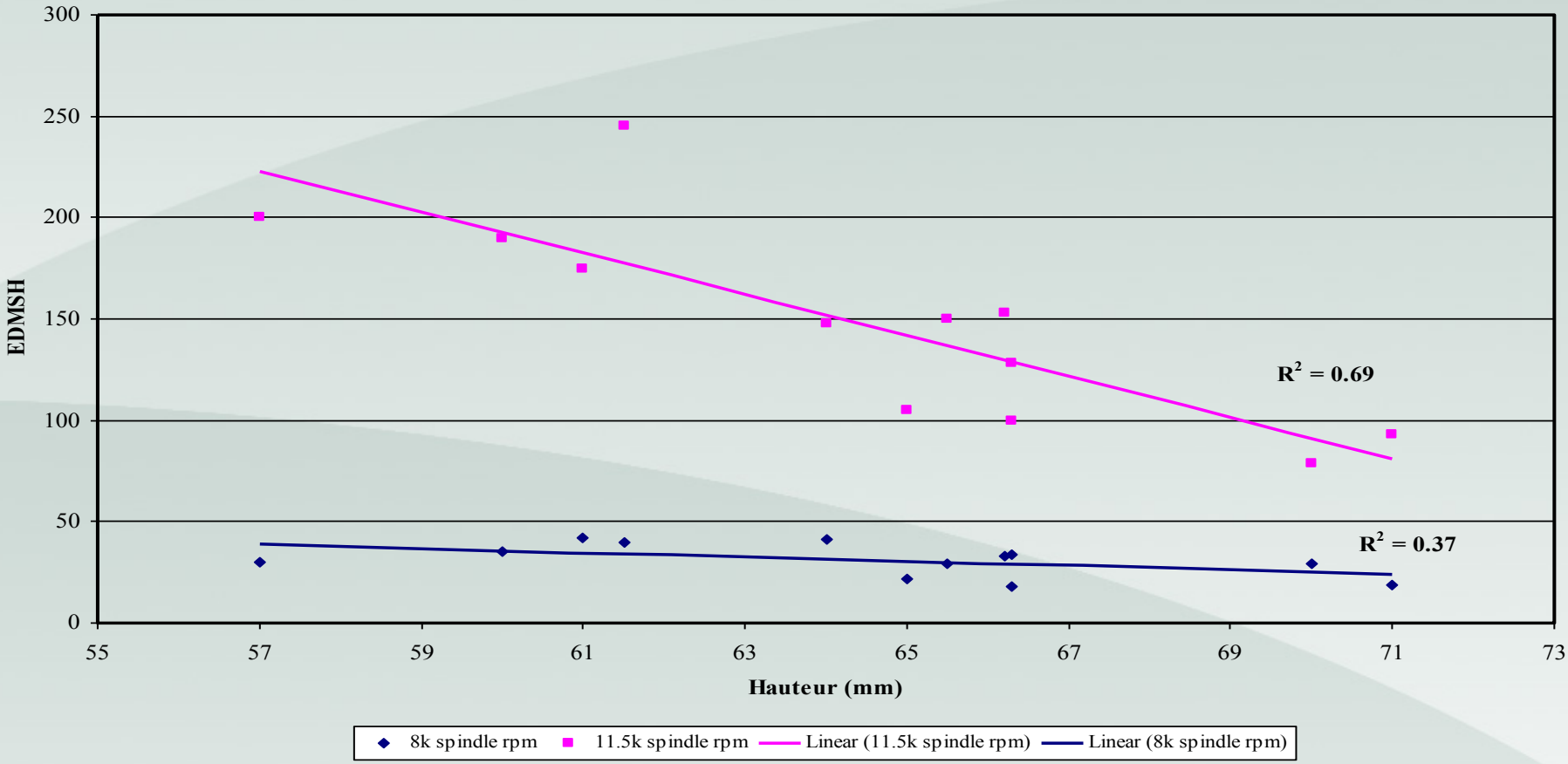
Hauteur, Staple Strength, and POB



Noil, Staple Strength, and POB

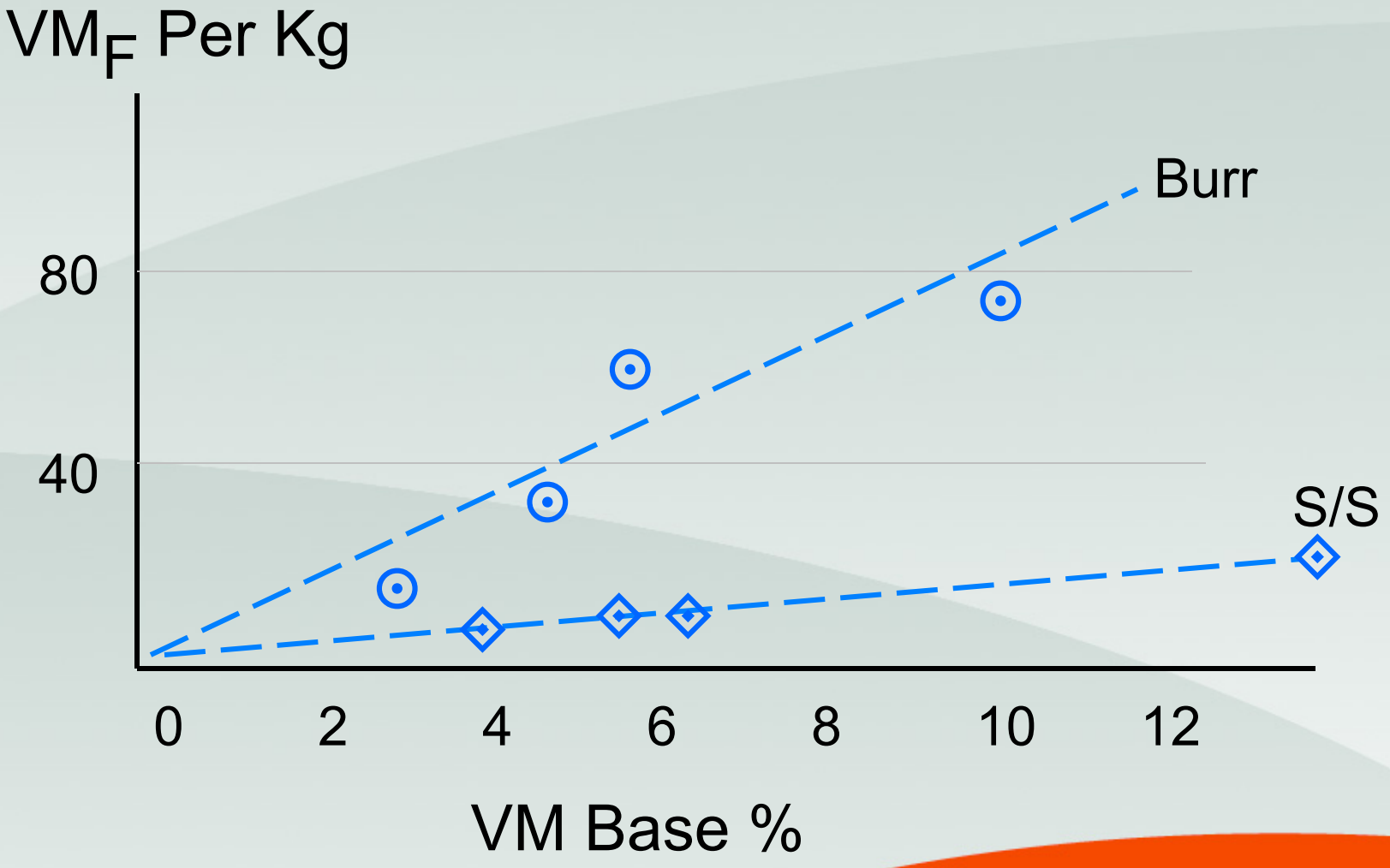


Spinning Breaks, Staple Strength, and POB



VEGETABLE MATER

VM Base and VM in Fabric



Vegetable Matter (VM)

Line	VM Base %	VM Top (Per Kg)		Holes in Fabric (per kg)	
		>3mm	>10mm	Total	Due to VM
B, AAA	2.7	14	1.0	2.4	0
B, Pcs	10.7	83	13.2	4.5	1.0
K, AAA	2.8	5.2	0.4	0.7	0
K, Pcs	10.3	5.8	0.6	3.9	0.1

FIBRE CRIMP

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Fibre Crimp

1. Problems with Measurement sample history/preparation

- fleece 
- combed 
- relaxed 

Fibre Crimp

- 2. Effects Process Variation
  - Yield – 0.5 to 1.0 % increase in Romaine for each 10degree/mm increase in curvature.

Fibre Crimp

- 2. Effects Process Variation

- Fabric Dimensions
  - higher crimp wool increase dimensional stability in use

- Fabric Weight
  - fabric weight clearly increases as fibre crimp increases
  - an increase of 85 to 100 deg/mm caused a 10gsm in 200gsm, (5%), increase.

Fibre Crimp

3. Effects Product Quality

- Pilling – higher crimp pill less
- Bulk – higher crimp gives greater bulk and cover (warmth?)
- Handle – higher crimp tends to give stiffer handle

Consumer Needs/Preferences

	Preference share %
• Soft Next to skin*	19
• Machine Washability	13
• Shape Retention	12
• Soft to Handle*	11
• Light Weight*	11
• Resist Pilling	10
• Crease Resistant	9
• Easy Ironing	9
• Tumble Drying	6

*41% - Fibre diameter related

End - Use

- Finishing and Fabric Structure >>Fibre Properties

Prickle

Property	Importance
• Fibre Diameter	10
• CVD (>27 micron)	3
• Fibre Length	2
• Yarn Count	0
• Cover Factor (knit)	4
• Finishing	10

Wrinkle Recovery, WR

WR - depends on relaxing stress

- lesser extent, fibre-fibre friction

Finer Wools – Worse (small)

Fibre crimp – Higher crimp better (small)

Pilling

Property	Relative Effect
Fabric Tightness	10
Yarn Twist	5
Fibre Diameter	5
Fibre Crimp	?

Colour

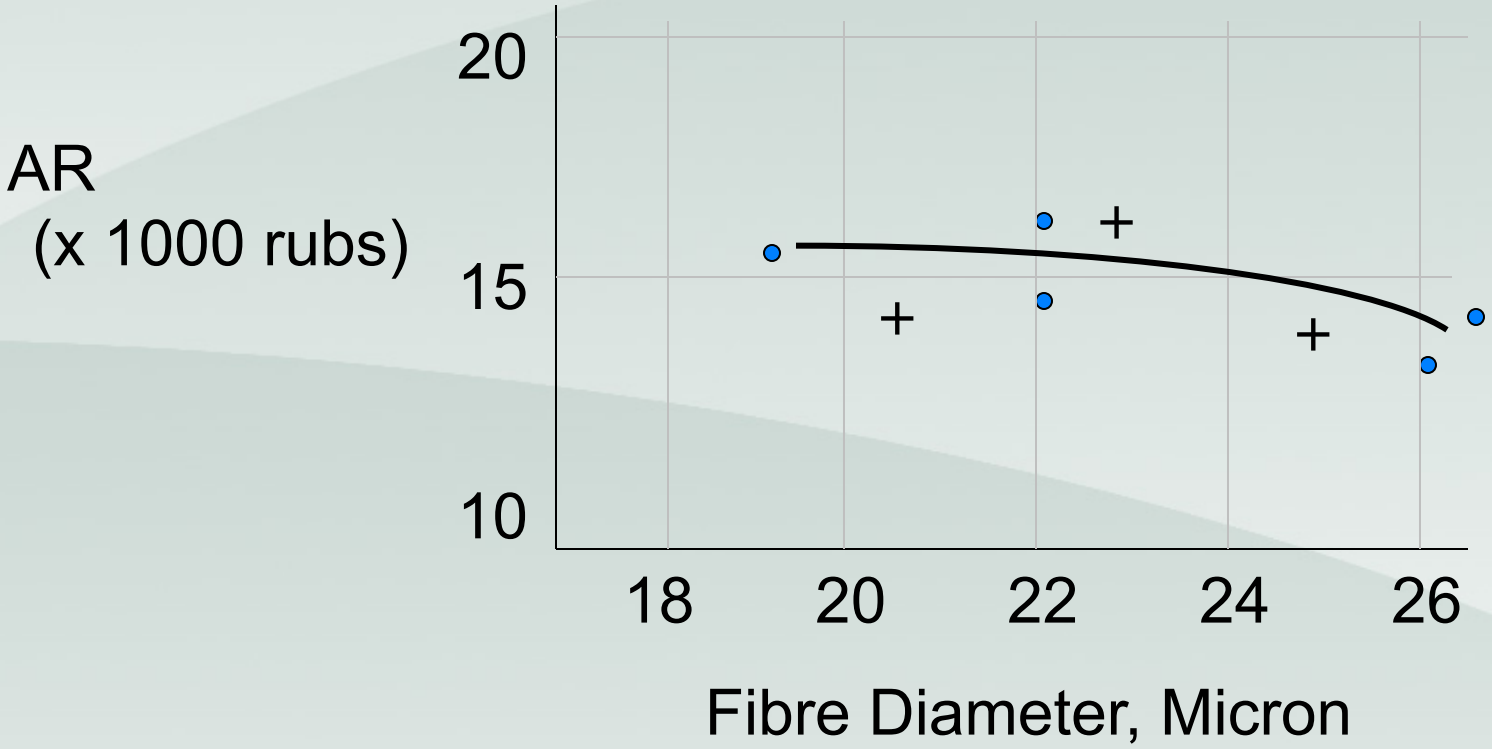
White, bright, pastel (Ladies Wear)

- need white wool

Dark Shades

- Colour is less important
- Uniformity of colour

Fibre Diameter and Abrasion Resistance (AR)



Fibre: Processing and Product

Greasy Wool Property	Processing	Fabric
Fibre Diameter	XXXX	XXXX
Yield	XXXX	X
Staple Length	XXX	X
Staple Strength/POB	XXX	X
Vegetable Matter	XXX	X
Clean Colour	XXX	XX
Dark Fibres	XX	XX
Fibre Diam. Variation	XX	X
Crimp/Curvature	XX	XX
Tip	X	X
Horizontal	✓	?
Vertical	✓	✓

XXXX (Most Importance)

X (Least Importance)

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