

Supplementary materials

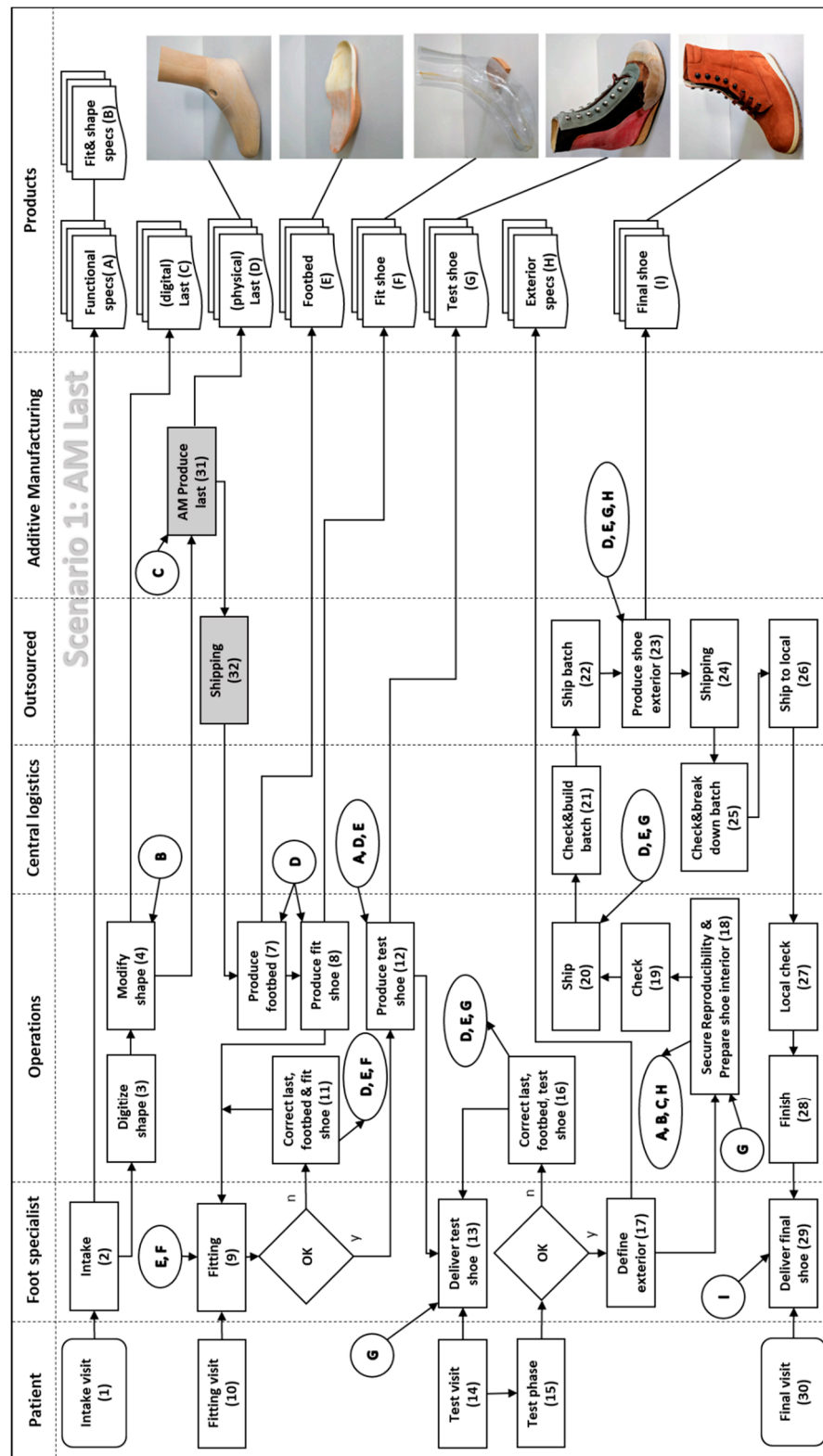


Figure S1. Process flow Scenario 1. AM of the last.

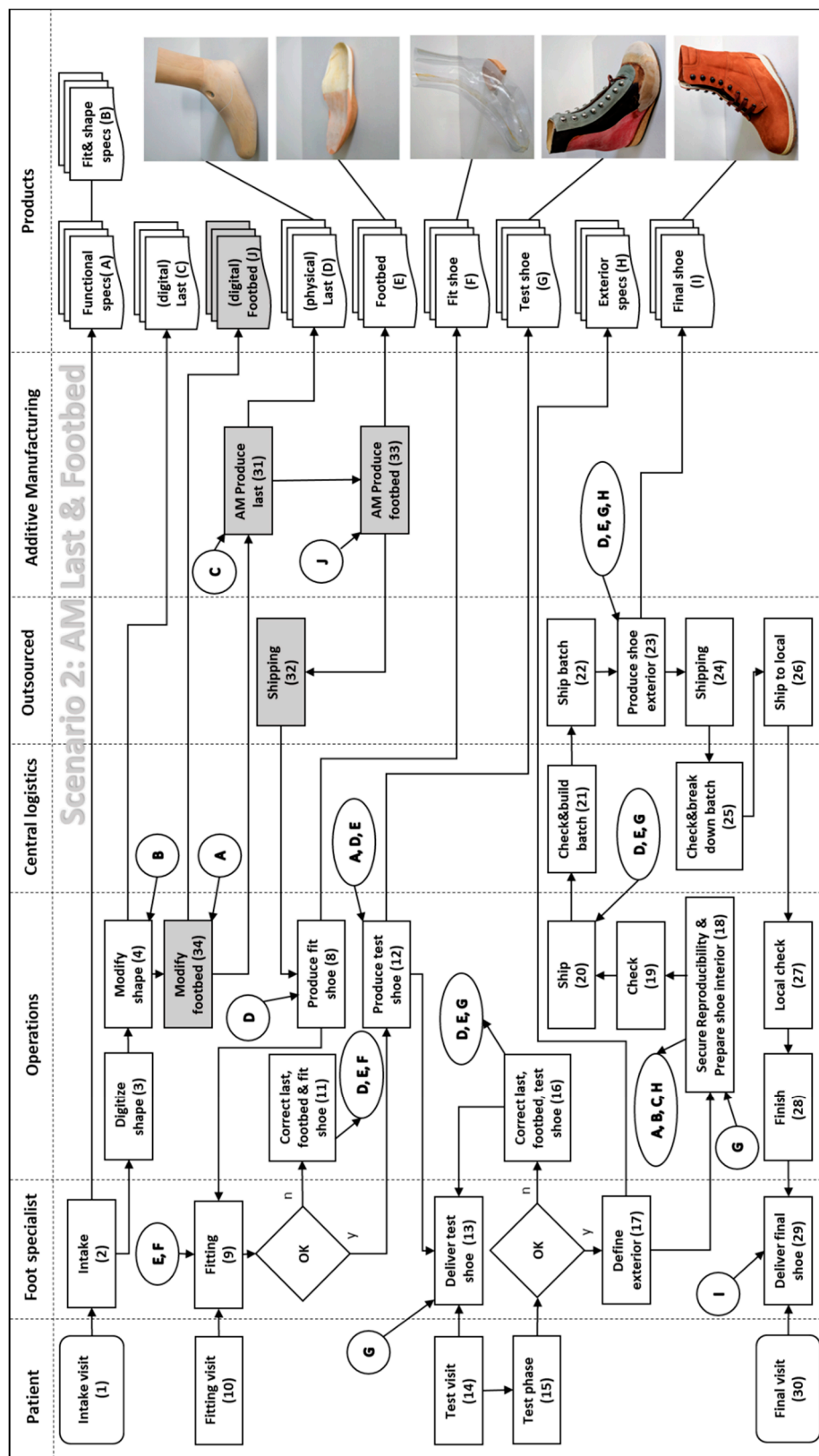


Figure S2. Process flow Scenario 2. AM of the footbed.

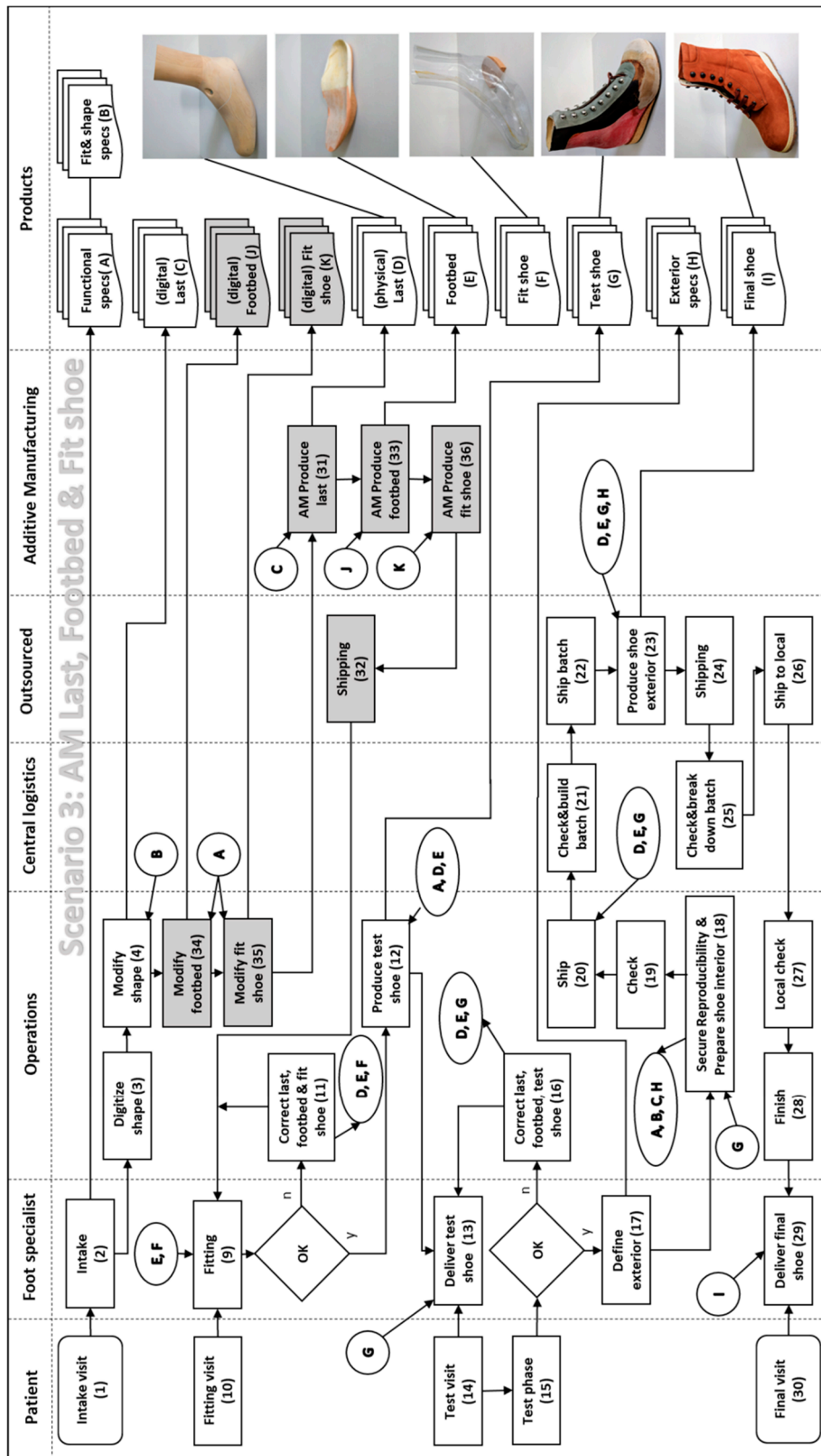


Figure S3. Scenario 3. AM of the fitting shoe.

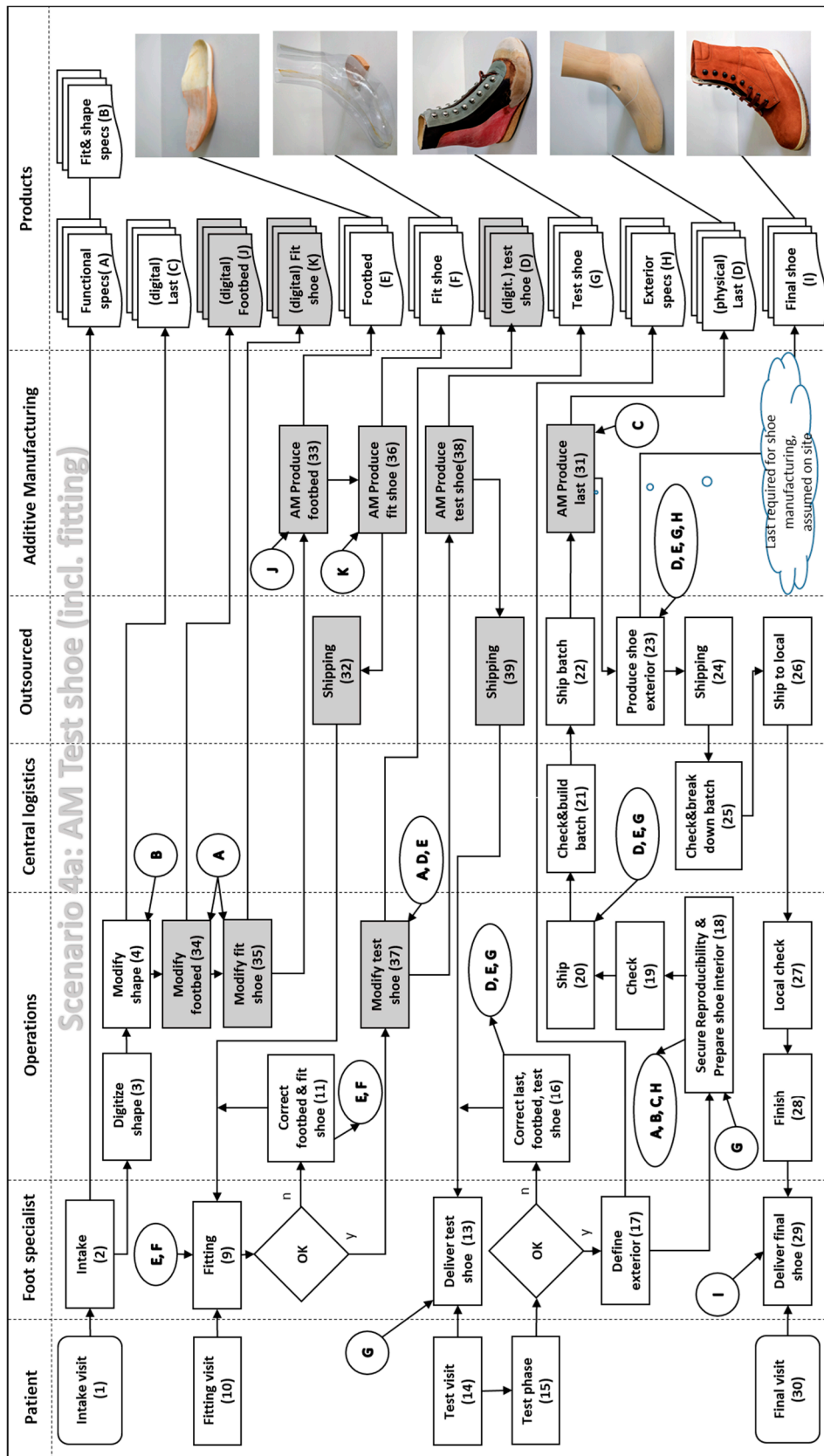


Figure S4. Process flow Scenario 4a. AM of the test shoe (including fitting process).

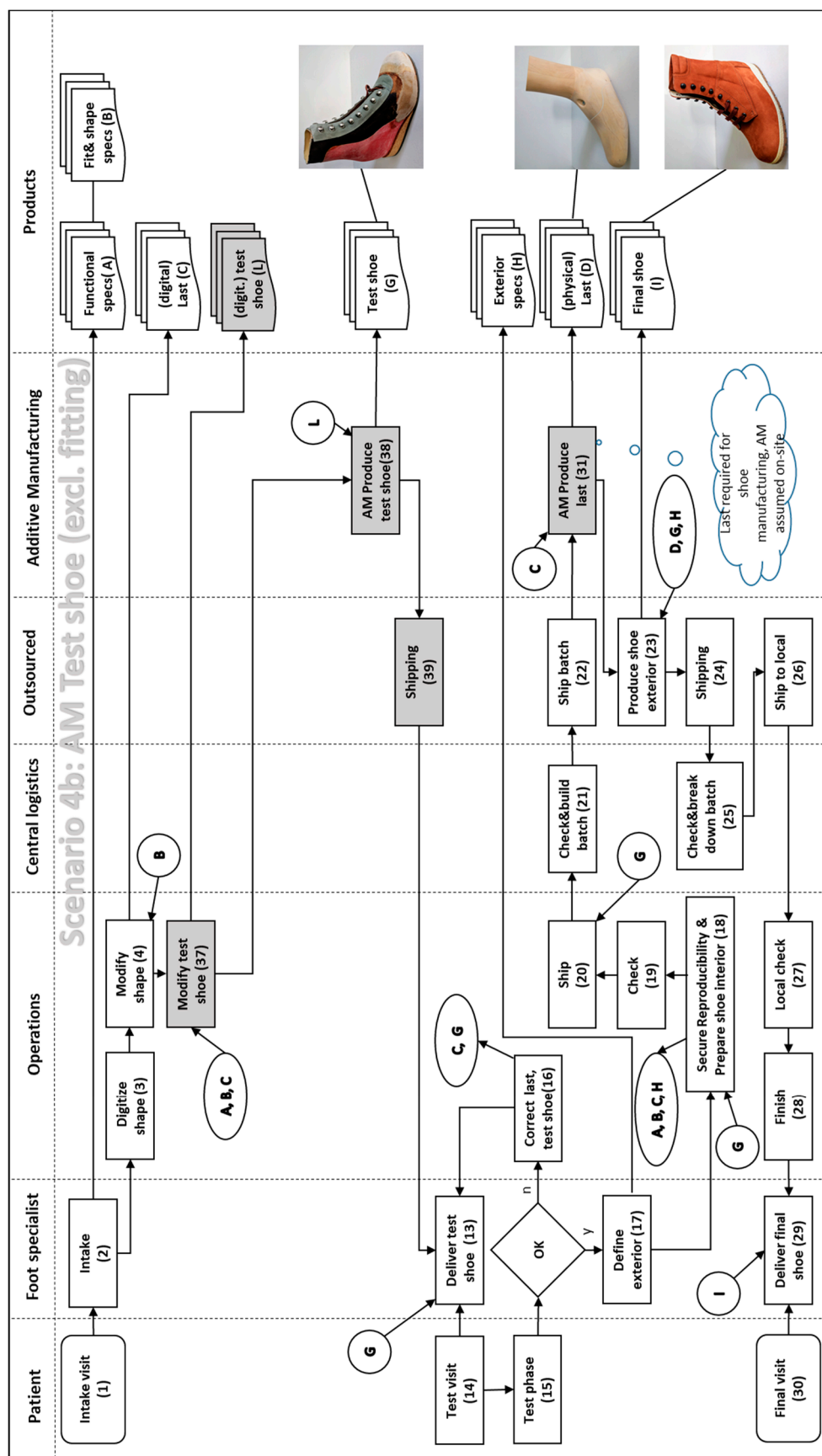


Figure S5. Process flow Scenario 4b. AM of the test shoe (excluding fitting process).

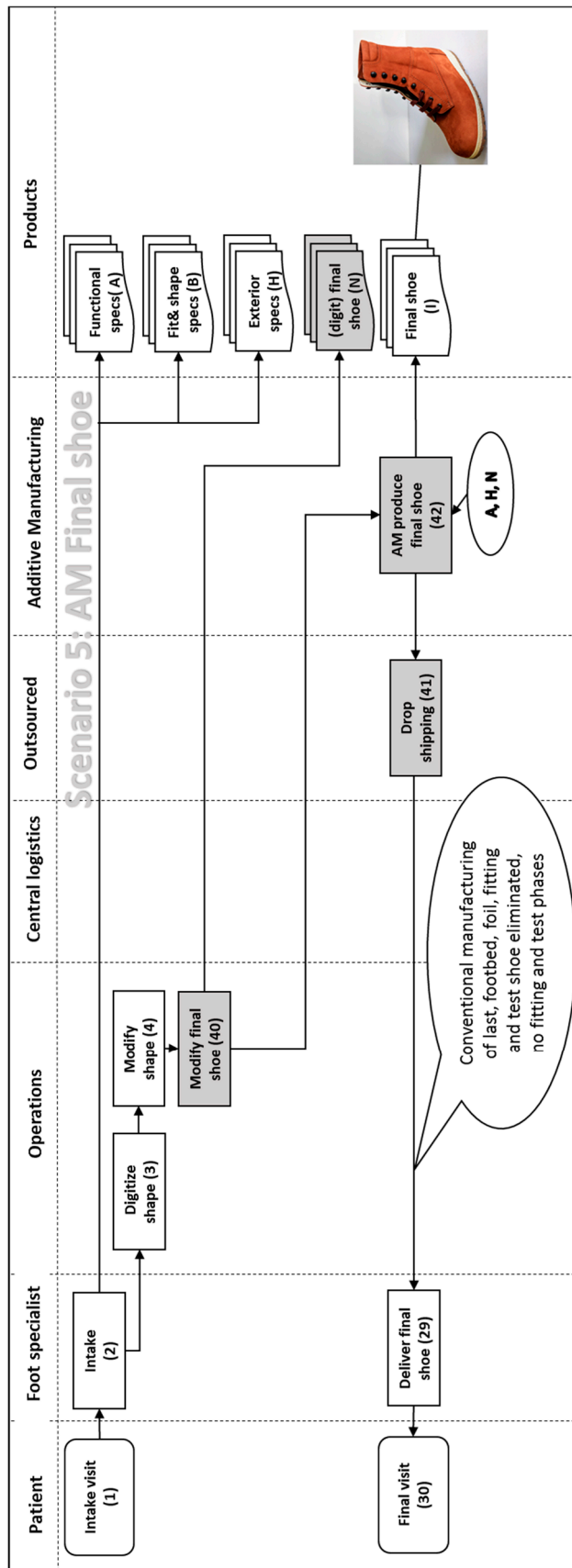


Figure S6. Process flow Scenario 5. AM of the final shoe.

<i>Description</i>	<i>Relevant scenarios</i>	<i>Year</i>	<i>AM Technical feasibility score (7-point Likert scale)</i>						
			<i>Definitely possible</i>	<i>Likely possible</i>	<i>Probably possible</i>	<i>Neither possible nor impossible</i>	<i>Probably impossible</i>	<i>Likely impossible</i>	<i>Definitely impossible</i>
<i>AM Production of last</i>	<i>1, 2, 3, 4a, 4b</i>	<i>2020</i>	*						
		<i>2025</i>	*						
		<i>2030</i>	*						
<i>AM Production of foot bed</i>	<i>2, 3, 4a</i>	<i>2020</i>		*					
		<i>2025</i>	*						
		<i>2030</i>	*						
<i>AM Production of fitting shoe</i>	<i>3, 4a</i>	<i>2020</i>		*					
		<i>2025</i>	*						
		<i>2030</i>	*						
<i>AM Production of test shoe</i>	<i>4a, 4b</i>	<i>2020</i>						*	
		<i>2025</i>			*				
		<i>2030</i>	*						
<i>AM Produce final shoe</i>	<i>5</i>	<i>2020</i>							*
		<i>2025</i>				*			
		<i>2030</i>	*						

Table S1. AM feasibility.

<i>Relevant scenarios</i>	<i>Description</i>	<i>2020</i>	<i>2025</i>	<i>2030</i>	<i>2035</i>
<i>1, 2, 3, 4a, 4b</i>	<i>AM Production of last</i>	<i>150.00</i>	<i>90</i>	<i>75</i>	<i>75</i>
<i>2, 3, 4a</i>	<i>AM Production of foot bed</i>	<i>75.00</i>	<i>55.0</i>	<i>50.0</i>	<i>45</i>
<i>3, 4a</i>	<i>AM Production of fitting shoe</i>	<i>200.00</i>	<i>150.0</i>	<i>100.0</i>	<i>100</i>
<i>4a, 4b</i>	<i>AM Production of test shoe</i>		<i>375.0</i>	<i>250.0</i>	<i>250</i>
<i>5</i>	<i>AM Produces final shoe</i>		<i>750</i>	<i>500</i>	<i>500</i>

Table S2. Cost estimates AM components in €.

			<i>Digital design feasibility score (7-point Likert scale)</i>						
<i>Description</i>	<i>Relevant scenarios</i>	<i>Year</i>	<i>Definitely possible</i>	<i>Likely possible</i>	<i>Probably possible</i>	<i>Neither possible nor impossible</i>	<i>Probably impossible</i>	<i>Likely impossible</i>	<i>Definitely impossible</i>
<i>Digital last</i>	<i>1, 2, 3, 4a, 4b</i>	<i>2020</i>		*	*				
		<i>2025</i>	*	*					
		<i>2030</i>	**						
<i>Digital foot bed</i>	<i>2, 3, 4a</i>	<i>2020</i>		*	*				
		<i>2025</i>	**						
		<i>2030</i>	**						
<i>Digital fitting shoe</i>	<i>3, 4a</i>	<i>2020</i>		*	*				
		<i>2025</i>	*	*					
		<i>2030</i>	**						
<i>Digital test shoe</i>	<i>4a, 4b</i>	<i>2020</i>		*	*				
		<i>2025</i>	*	*					
		<i>2030</i>	**						
<i>AM Produces final shoe</i>	<i>5</i>	<i>2020</i>		*	*				
		<i>2025</i>	*	*					
		<i>2030</i>	**						

Table S3. Digital design feasibility, * represents one expert opinion each.

COSTS				
Description	Amount	unit	Related process steps	Explanation
Equipment				
available hours/year for equipment = 40h/week * 50 available weeks/year = 2000h	2000	h		
Tablet, cell phone, orthomedic software	2,07	€/h	2, 9, 13, 29	Orthomedic software 270€/month/practitioner; tablet/cell phone 2700€/3 years
Scanner	7500	€/y	3	3 locations, 10k€/4y; Scanner is only used for this purpose : cost calculated on order volume (not hourly rate)
PC	0,25	€/h	4	2k€/4y
Rhino/Lutracad software	11880	€/y	4	3 locations, 3k€/license/y; plus software 80€/month; software only used for this purpose: cost calculated on order volume (not hourly rate)
PC & software	0,97	€/y	19,21,25,27	PC= 2k€/4y software = 120€/month
New, smart design software	10000	€/y	34	Assumption to be verified; SW only used for this purpose: cost calculated on orders volume
Grinding machine	1	€/h	7, 11, 12	20k€/10y
Press	0,20	€/h	7, 12	4k€/10y
Oven	1,00	€/h	7, 12	10k€/5y
Vacuterm	0,5	€/h	8	10k€/10y
Facility				
available hours/year for facilities= 40h/week * 50 available weeks/year = 2000h	2000	h		
Facility cost operations	190	€/m 2/y		Rental, includes heating, lighting, basic interior (work benches); includes warehouse, offices, factory
Facility cost operations	0,10	€/m 2/h		
Facility cost treatment rooms	260	€/m 2/y		based on 65% utilization rate
Facility cost treatment rooms	0,13	€/m 2/h		
Treatment room	20	m2		
Scan room	16	m2		
Operational cell	30	m2		includes grinding, press, oven, vacuterm, work bench
Logistics operations	16	m2	21, 25	
Human Resources				
Foot specialist	55	€/h		based on 1200h/year effectively
Junior operator	25	€/h		based on 1200h/year effectively
Senior operator	37	€/h		based on 1200h/year effectively
Material				
Cast	15	€/or der	2	
footbed	12	€/or der	7	
Foil	8	€/or der	8	
Correction	5	€/or der	11	
Test shoe - with functional provision	40	€/or der	12	
Test shoe - without functional provision	20	€/or der	12	
Outsourced				
Last manufacturing	90	€/or der	5	

Ship last to local	10	€/or der	6	
Ship local to central vv	10	€/or der	20	
Ship to external manufacturing	10	€/or der	22	Ship in batches, cost per pair
Shoe exterior manufacturing	260	€/or der	23	includes return shipping cost
TIME				
Description	Amount	unit	Related process steps	Explanation
Time calculation=(1/3*3.5h)+(2/3*1.5h)			12	
Phillipines 15d/China 17d/Lituania 15d, time includes shipping vv			22, 23, 24	
VOLUME				
Description	Amount	unit	Related process steps	Explanation
Order volume	1500			One order consists of two (semi-finished) shoes
Amount of scan locations	3			
% of orders cast	80 %		2	
Last, footbed, foil corrections	100 %		11	
Test shoe - with functional provision	33 %		12	
Test shoe - without functional provision	67 %		12	
Last, footbed, test shoe corrections	50 %		16	
Ship from 4 locations, minus central. Volume evenly spread over locations	75 %		20	
OTHER				
If a work cell (grinding/press/oven) is not working on an order, it is available for other orders outside.				
If a work cell (grinding/press/oven) is working on an order, it is not available for other orders, the processing time of then applies to all machines				

Table S4. Assumptions for calculation.

1	5	Test phase	exclude											
1	6	Correct last, footbed, test shoe	include	0,33		Operational cell	0,48	Senior operator	6,17					6,64
1	7	Define exterior	include	0,50		Treatment room	1,30	Foot specialist	27,50					28,80
1	8	Secure reproducibility & prepare shoe interior	include	0,25		Operational cell	0,71	Senior operator	9,25					9,96
1	9	Check	include	0,08	PC & software	0,08	Operational cell	0,24	Senior operator	3,08				3,40
2	0	Ship	include	24,00								Ship local to central vv	7,5	7,50
2	1	Check & build batch	include	0,17	PC & software	0,16	Logistics operations	0,25	Senior operator	6,17				6,58
2	2	Ship batch	include	360,00								Ship to external manufacturing	10	10,00
2	3	Produce shoe exterior	include									Shoe exterior manufacturing	260	260,00
2	4	Shipping	include											
2	5	Check & break down batch	include	0,08	PC & software	0,08	Logistics operations	0,13	Senior operator	3,08				3,29
2	6	Ship to local	include	24,00								Ship local to central vv	7,5	7,50
2	7	Check	include	0,08	PC & software	0,08	Operational cell	0,24	Senior operator	3,08				3,40
2	8	Finish	include	0,33			Operational cell	0,95	Junior operator	8,33				9,28
2	9	Deliver final shoe	include	0,50	Tablet, cell phone, orthomedic software	1,04	Treatment room	1,30	Foot specialist	27,50				29,84
3	0	Final visit	exclude											
			Sum	465,58		26,91		24,95		402,19		69,02	Outsourced	350,00
												Transportation	35,00	
												AM	0,00	
												Sum		908,06

Table S5. Calculations for Scenario 0.

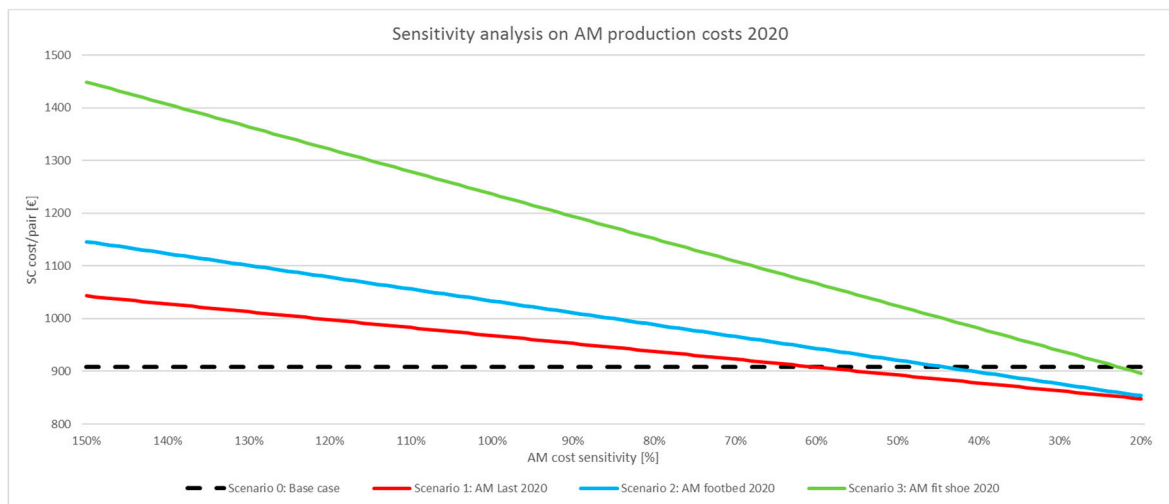


Figure S7. Effect of AM cost on total SC costs (2020).

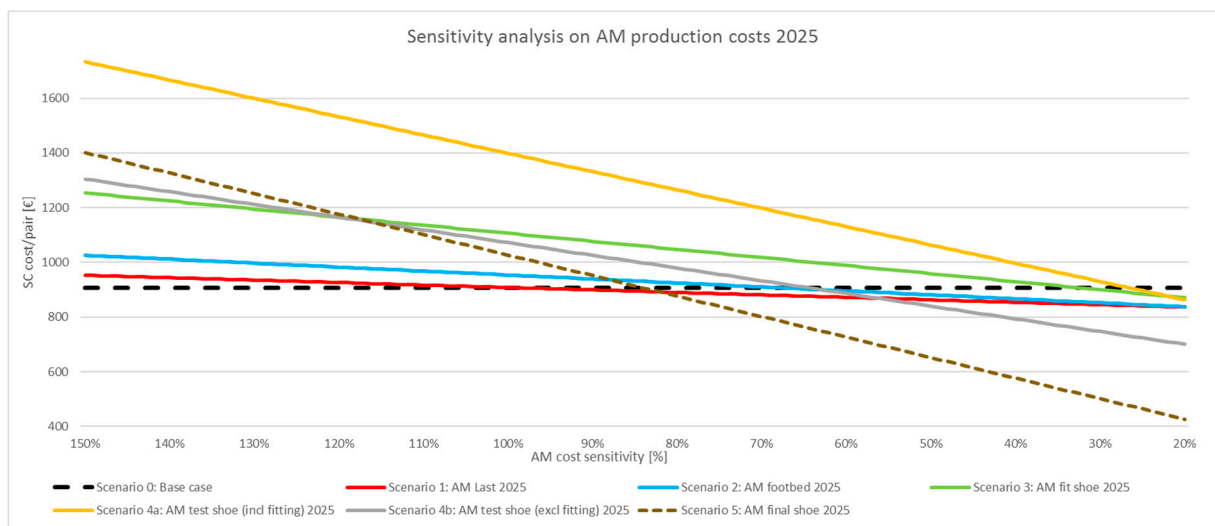


Figure S8. Effect of AM cost on total SC costs (2025).

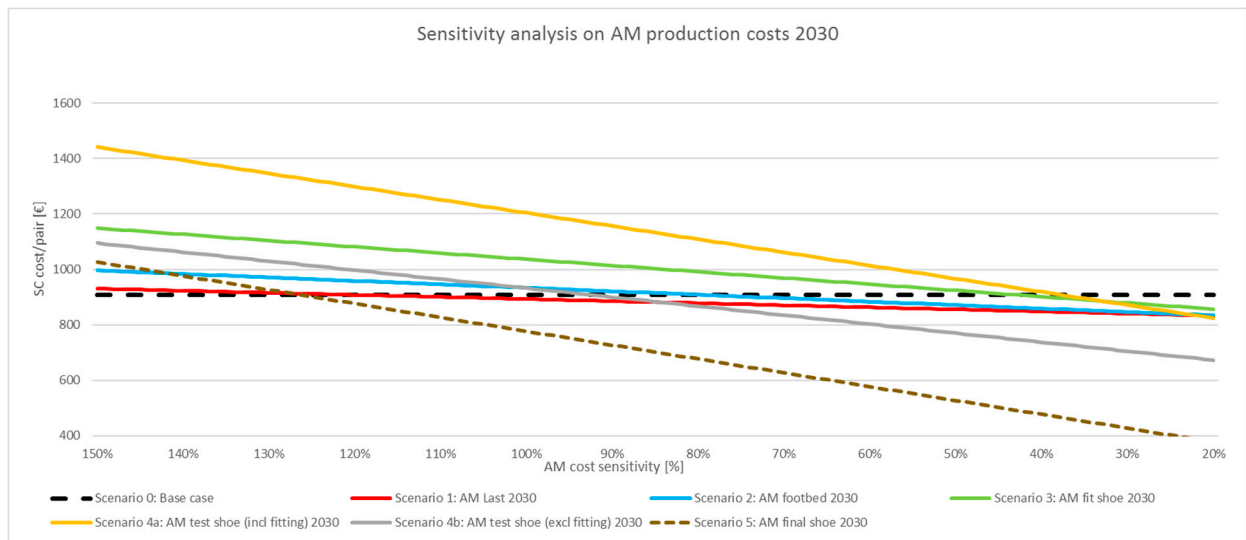


Figure S9. Effect of AM cost on total SC costs (2030).