

A soldier in a ghillie suit is shown in profile, looking through binoculars. The soldier is wearing a full-body ghillie suit made of dry grass and twigs, which blends into the background of trees. The soldier's face is partially visible through the suit's mesh. They are holding a rifle, which is also partially visible. The background is a blurred forest scene with green and brown foliage.

Cranfield
University

**Networking value
with Armadillo**
Executive summary

March 2016

Corporate Sustainability
Consultancy

Innovate UK



ARMADILLO

Networking value with Armadillo

Between October 2015 and March 2016 The Ministry of Wool trading as Armadillo Merino® conducted a feasibility study in collaboration with Cranfield University. The feasibility study aimed to develop a suitable circular business model for Merino garments, to propose an alternative supply system based on a value network for the Ministry of Defence (MOD) that could be replicable for other sectors.

The achievements of this feasibility study were:

- Obtained a better understanding of the current MOD's supply chain through an analysis of the MOD's challenges and opportunities.
- Acquire knowledge of the current system to reproduce a reference system to be analysed.
- Acquire sufficient knowledge to develop a Product Service System (PSS) Circular Business Model.
- Complete a screening Life Cycle Assessment of the reference system and the PSS circular business model.
- Produced an Exploitation Plan.

Proposed solution

The proposed solution is based on the concept that Armadillo Merino® owns and manages a Special Forces supply pool for next-to-skin garments and leases these garments directly to the MoD.

The PSS would provide live inventory management of high quality garments that will offer a safer, more comfortable user experience for MOD personnel by providing them with next to skin garments (for the purpose of this study it was considered the supply of short sleeve t-shirts in light olive and/or coyote brown) that require less maintenance and provide enhanced levels of protection, performance, comfort and safety. Soldiers love wearing their Armadillo Merino® garments and have security and a sense of pride when wearing them. Figure 1 shows the areas of responsibility for Armadillo Merino®, including the logistics associated with reuse and redistribution, refurbishment and redistribution.

Easier to do



Figure 1: Areas of responsibility of Armadillo Merino®

Project impact

The project impact would be in changing the current procurement system of the MOD through a “proof of principle” case study with the development of a PSS to supply next-to-skin merino garments to the MOD.

The key drivers for the MoD for implementation of the proposed business model is:

- **Assets** - Currently any equipment that has been purchased by the MOD including next-to-skin garments would be considered as assets. Assets are accountable to the Treasury. The MOD is seeking ways of reducing the levels of assets they own, so that the Treasury doesn't charge them. This new approach reduces the annual procurement costs and inventory management costs of up to £226,000¹, as Armadillo will supply the required quantity of garments on demand. The proposed model could help the MOD to reduce their annual expenditure by only allocating the yearly leasing service within their annual costs.
- **Armadillo takes on the responsibility of supplying garments and being responsive in meeting the required drawdowns of inventory**, which could reduce costs by £226,000. An additional benefit is that this system will offer a more transparent process on the movement and performance of next-to-skin garments being used by the MoD.
- **Extending the supply pool to also include next-to-skin garments could reduce the environmental impact.** The screening LCA demonstrated that the total impacts on climate change per functional unit (FU) is 17.7kg Co²e in the reference system and 7.0kg Co²e in the proposed circular PSS. This is assuming that 75% of the clothes will be returned back to the pool for repurposing (repair and maintenance) and reissuing thereby extending their lifetime. In addition, it was assumed that the washing temperature will be 30°C and that the virgin material substitution rate would be 30%. In addition, the pool could take responsibility of garments at the end of life with a range of options such as the recycling of fibres into other army applications (blankets, sound buffering, compression pads, etc.) when the garments are beyond repair. This will help redirect thousands of garments that would normally be burnt or discarded into landfill.

¹This is calculated on their 50% inventory stock of synthetics held for up to a year at 5% annual interest.

Project impact

The commercial benefits for Armadillo Merino® include:

- The PSS could use the MOD freight system, which would collect and return garments from the field reducing the management and cost of logistics by up to £181,153 year. The MOD freight system is an internal freight service that operates at all times for the control and supply of equipment.
- Guaranteed revenue for Armadillo Merino® of £15 to £16m per year by providing a fixed leasing service to the MOD.
- Minimise costs up to £100,000 by outsourcing and subcontracting certain parts of the service.



Sustainability impacts

The implementation of the PSS will have significant social and environmental benefits such as:

- Provision of a high performance, trans-seasonal and durable next to skin garment that requires less maintenance with enhanced levels of user protection, comfort and safety.
- **Safety:** In Iraq and Afghanistan the MoD destroyed about 60% standard issues next to skin garments at the conclusion of tours in 2011. These garments were incinerated in burn pits with tires, packaging, waste material and other equipment. The garments were burned instead of returning the garments to the UK for recycling or reuse. The next-to-skin garments issued during these tours were 100% petrochemical based. When burned these garments released a toxic cocktail of chemicals impacting the health and well being of British soldiers following burn-pit exposure. In the USA more than 30,000 combat veterans that had completed surveys reporting failing health issues that have been associated with burn pit exposure. The proposed PSS would avoid using the burn pits for disposal in conflict zones with the expectation that the next-to-skin garments would be returned to the UK and where possible be given a second life.
- **Protection:** Polyester and synthetic next to skin garments melt and drip into the skin when exposed to heat and flames and when ignited will burn robustly. Armadillo Merino® next to skin garments use the natural protective properties of merino wool which don't melt or drip and is naturally flame resistant up to 600C protecting soldiers from unnecessary injuries.
- **Comfort:** Merino next-to-skin garments help delay the onset of sweating by up to 50% in comparison to synthetic products. The breathable merino fibre helps the thermoregulation of the body and actively manages moisture, improving the stamina and speed of recovery of a soldier and comes with the added bonus of not producing odour even after prolonged periods of use.
- The development of a PSS Concept system for clothing could create a sustainable business model that would reduce CO₂ emissions in comparison to the current reference system.



Contributors

Cranfield University

Dr Fiona Charnley
Dr Mariale Moreno

Armadillo Merino®

Andy Caughey

Lead for Capability Development

Officer Ollie Braithwaite

Ex UK Armed Forces

Mark Hughes

University of Copenhagen

Nynne Marie Bech

Technical University of Denmark

Morten Birkved
Michael Z. Hauschild
Louise Laumann Kjaer
Tim C. McAloone
Daniela C. A. Pigosso

Contact us:

Cranfield University

Cranfield
MK43 0AL, UK

E: f.j.chnrnlry@cranfield.ac.uk
E: m.moreno@cranfield.ac.uk
T: +44 (0)1234 750111
www.cranfield.ac.uk