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CIRCULAR DESIGN STRATEGY IN A CAPSULE WARDROBE: INTERCHANGEABILITY AND DESIGN FOR LONGEVITY

Purpose. *To develop and conceptually evaluate a women's capsule wardrobe as a circular-design strategy integrating interchangeability, modularity and design for longevity, while distinguishing functional combinatorial performance from claims of environmental benefit.*

Keywords: *capsule wardrobe, circular economy, ecodesign, design for longevity, interchangeability, modularity, responsible consumption.*

Objectives. The objectives are: (1) to analyse current ecodesign and design-for-longevity principles relevant to apparel; (2) to examine the capsule wardrobe and selected reference systems by famous designers Donna Karan and Eileen Fisher; (3) to operationalise compatibility, modularity and interchangeability criteria; (4) to develop a quantitative structure and combinatorial matrix for a spring-autumn capsule; and (5) to define the empirical validation required to assess service-life extension and environmental performance.

Methodology. The study combines a focused literature review, comparative design analysis of reference clothing systems and matrix modelling of garment compatibility. The combinatorial potential is represented by formula $C = n \times m$, where n is the number of compatible upper-body garments and m the number of compatible lower-body garments; additional configurations arise through dresses, layering and modular components. Life-cycle thinking is used as an interpretative framework for durability, maintainability, repairability and use intensity. The study is prospective and design-based: no product-level life-cycle assessment (LCA) or longitudinal wear test is claimed at this stage [8-12, 15, 16].

Research results. The policy relevance of circular apparel design has strengthened. Regulation (EU) 2024/1781 establishes durability, repairability, reusability and recyclability among the parameters that may underpin ecodesign requirements, while the European Commission's 2025-2030 ESPR Working Plan identifies textiles/apparel as a priority product group, with product-specific measures scheduled for development [2, 3]. Ecodesign should therefore be understood as a life-cycle approach encompassing material selection, construction,

use, care, repair, disassembly, reuse and end-of-life recovery rather than as material substitution alone [1, 4, 7, 13].

Within this framework, the capsule wardrobe is interpreted as a design system rather than merely a method of wardrobe organisation. Its potential value derives from planned relationships between garments: a limited set developed within a coherent formal and chromatic language can generate multiple use configurations. The relevant design objective is therefore not simply to minimise the number of garments, but to increase useful service delivered by each garment through compatibility, repeated use and adaptability [5, 9].

Longevity is multidimensional. Physical durability concerns the ability of materials, seams and components to retain functional performance; aesthetic longevity concerns continued visual relevance; functional longevity concerns the capacity to respond to changing contexts; and emotional longevity concerns continued user attachment. Multifunctionality, transformability and personalisation may support these dimensions [8-12]. However, recent research shows that durability remains inconsistently operationalised across policy, labels and environmental assessment: physical performance tests do not automatically translate into actual lifetime or quantified environmental benefit [14].

Design for longevity consequently requires decisions that anticipate use, maintenance and possible failure. Relevant strategies include high-quality materials, adaptable forms, repair-accessible construction, replaceable or detachable components, alteration allowances and appropriate care requirements [8, 10-12]. Mono-materiality can facilitate recycling in some cases, but should not be treated as an absolute criterion: fibre performance, seam strength, care intensity, repairability, user retention and realistic recovery pathways must be considered together [13, 14].

The capsule-wardrobe concept evolved from a restricted core of essential garments towards a broader system of planned compatibility. Susie Faux is associated with the early formulation of the concept, while Donna Karan later demonstrated its commercial versatility through Seven Easy Pieces. Contemporary research increasingly links capsule wardrobes with use intensity, creativity and more reflective consumption rather than with minimalism alone [5].

As design precedents, Donna Karan's Seven Easy Pieces and Eileen Fisher's The System illustrate different routes to the same systemic principle. Karan emphasises a structured foundation, layering and rapid transition between professional and social contexts; Fisher relies on relaxed forms, chromatic continuity and layering to support multiple combinations. Their relevance to the

present study lies in planned compatibility between garments, not in treating either system as direct evidence of environmental sustainability [5].

For the proposed capsule, aesthetic longevity is operationalised through restrained colour relationships, recognisable silhouettes and a balance of structured and fluid forms. The neutral palette - brown, beige, white and ivory - is used as a compatibility device rather than as a claim of timelessness. Contemporary details are introduced only where they do not reduce the capacity of garments to be recombined across contexts and seasons.

The technical foundation of the proposed system is interchangeability, defined as the capacity of one garment to participate in several combinations without loss of stylistic, chromatic or functional coherence. Interchangeability is complemented by modularity and transformability: detachable or adjustable elements can alter silhouette, function or degree of formality without requiring a complete additional garment [8, 9]. The proposed quantitative structure is presented in Table 1.

Table 1 –**Quantitative and functional structure of the proposed capsule**

Product category	No.	Examples of garments
Upper-body garments	5	Shirts, fine-gauge knitwear, blouses, structured tops
Lower-body garments	4	Pencil skirt, flared trousers, structured separates
Dresses (integrated garments)	1	Versatile day/evening dress
Outerwear	1	Structured coat or transitional jacket
Footwear	2	Office shoes; seasonal ankle boots
Bags	2	Day bag; evening bag

Four criteria operationalise interchangeability: (1) stylistic compatibility, preserving coherent proportions and level of formality; (2) chromatic compatibility, based on a controlled core palette and limited accents; (3) functional compatibility, allowing the same garment to serve several contexts; and (4) compatibility for layering and transformation, enabling changes in thermal comfort, silhouette and formality without adding entirely new products [9].

From a combinatorial perspective, the basic relation is $C = n \times m$, where n denotes compatible upper-body garments and m compatible lower-body garments. Dresses, outer layers, modular elements and accessories create additional configurations beyond this core relation. The equation is not used as evidence of sustainability. It is a design instrument for assessing functional redundancy: garments that participate in few combinations identify possible areas for redesign.

The matrix can therefore support pre-production decisions by revealing whether each item contributes sufficiently to the system.

A greater number of upper-body garments is used to diversify visible combinations without proportionally increasing the total product count. The meaningful indicator is not outfit count alone, but the relationship between functional combinations, number of garments and prospective frequency of use.

The environmental rationale for this approach is relevant in a context of persistently high textile consumption: the European Environment Agency reports average EU consumption of 19 kg of clothing, footwear and household textiles per person in 2022 and emphasises the need for longer use, reuse, repair and recycling [6]. Nevertheless, a capsule wardrobe is not intrinsically circular. Its environmental performance depends on material and construction quality, maintenance, repairability, actual utilisation, displaced purchases and the eventual reuse or recovery pathway [1, 4, 6, 14].

The economic dimension may be illustrated through cost per wear, which relates purchase cost to frequency of use. This is useful as a consumer-oriented indicator of utilisation, but it should not be interpreted as an environmental metric. A more expensive garment can be economically efficient when used frequently and retained for longer, while environmental benefit still depends on whether extended use actually delays replacement and avoids additional production [8, 10–12].

At the behavioural level, a capsule system may shift attention from frequent acquisition towards recombination and continued use. Research on everyday creativity suggests that a deliberately limited wardrobe can stimulate experimentation and more reflective purchasing and care practices [5]. Multifunctional design can further support emotional longevity through variability and personalisation [9].

On the basis of these criteria, the experimental Reinterpreted Classic project was developed for active women aged approximately 20-45 for the spring-autumn transition season. The concept combines a controlled neutral palette, structured and fluid forms, planned interchangeability and modular elements. The removable peplum belt, together with waistcoats and jackets, modifies proportion and formality without requiring a complete additional garment. Future prototypes should incorporate durable materials, repair-accessible construction and alteration or replacement allowances where technically appropriate [8–12].

The matrix generates at least 26 outfit configurations by combining the core garments with layering elements and the modular peplum belt. This demonstrates functional interchangeability within the proposed design model, but does not by itself demonstrate environmental benefit. The intended mechanism is increased use

intensity: each garment is assigned several styling and contextual functions, which may reduce replacement pressure if users actually retain and wear the products more frequently [9]. Environmental validation requires prototype testing, durability and repairability assessment, and longitudinal wear data.

Table 2 – **Combinatorial matrix of the proposed capsule collection**

Upper-body / layering	Pencil skirt	Flared trousers	Sleeveless dress
Puff-sleeve blouse	Outfit 1	Outfit 9	–
Blouse + peplum belt	Outfit 2	Outfit 10	–
Blouse + waistcoat	Outfit 3	Outfit 11	–
Structured jacket	Outfit 4	Outfit 12	Outfit 17
Classic shirt	Outfit 5	Outfit 13	–
Shirt + peplum belt	Outfit 6	Outfit 14	–
Shirt + waistcoat	Outfit 7	Outfit 15	–
Shirt + jacket	Outfit 8	Outfit 16	–
Dress worn independently	–	–	Outfit 18
Dress + peplum belt	–	–	Outfit 19
Dress + waistcoat	–	–	Outfit 20
Jacket + waistcoat + peplum	+2 combinations	+2 combinations	+2 combinations

The peplum belt is the principal modular transformation element. When combined with a blouse, shirt, dress or jacket, it changes the silhouette without introducing another complete garment; waistcoats and jackets provide further layering options. This approach is consistent with morphological transformation and multifunctional design, in which reconfigurable components extend use scenarios and may support longer retention [8, 9].

The principal limitation is the projective nature of the evaluation. Combinatorial performance can be calculated before production, whereas comfort, physical durability, maintainability, frequency of wear, user attachment and displaced purchasing require empirical observation. A subsequent stage should therefore include prototype production and a defined wear study recording use frequency, maintenance and repair interventions, configuration preferences and reasons for retention or rejection. Where sufficient data are available, these observations should be complemented by product-level LCA or another transparent environmental assessment method.



Fig. 1. **Combinations of women's garments in capsule collection**
Source: developed by the author.

Conclusion. The capsule wardrobe can be treated as a circular-design strategy when numerical reduction is combined with durability, adaptability, repairability, modularity and credible reuse or recovery pathways. Donna Karan and Eileen Fisher provide useful precedents for system-level compatibility, while current design-for-longevity research demonstrates that durability must be understood beyond isolated physical tests. The Reinterpreted Classic model produces at least 26 configurations from a controlled product core, demonstrating functional efficiency at the design stage. This result should be interpreted as prospective evidence of use potential rather than proof of environmental impact. The next research stage should validate prototypes through technical durability and repair testing, longitudinal user observation and, where possible, environmental assessment linking actual service life to avoided replacement.

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