IO5 Instrumente virtuale pentru formare

Stimularea inovației bazată pe cunoștințe creative

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Instrumente virtuale pentru invatare
Stimulare a inovației bazată pe cunoștințe creative

Cadrul general

Proiectul DigiTEX își propune să susțină abordări inovatoare și tehnologii de învățare digitală pentru a accelera inovarea, predarea și învățarea în domeniul designului, testării și fabricării de textilelor 3D medicale, de protecție, senzoriale și a produselor inovatoare inteligente avansate pentru sanatate (echipamente de protecție, dispozitive de monitorizare purtabile) în contextul economiei digitale.

Obiective specifice

Instrumentele virtuale de co-design și managementul produsului de la idee la utilizatorul final se bazează pe un nou concept de implicare a utilizatorului final în co-designul produselor pentru domeniul sănătății, securității și industriei prin intermediul instrumentelor online și metodelor creative.

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CUPRINS

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DIGITEX

Metode creative pentru co-designul componentelor inteligente

Autor: Aileni R.M., INCDTP, Bucuresti, Romania

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Metode creative pentru co-designul componentelor inteligente

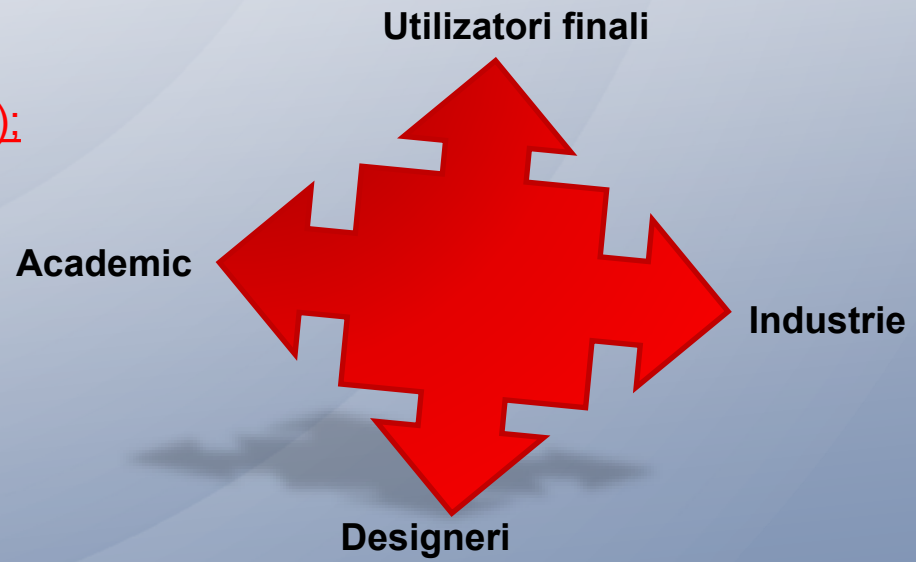
Co-design si metode creative

Co-designul poate produse rezultate diferite, de la informatii sub forma de date, harti cognitive pana la modele ale produselor si serviciilor. În prealabil, participanții trebuie să fie pregătiți, trebuie să se gândească și să reflecteze asupra subiectului de studiat.

Metodele creative sunt utile pentru co-design si inovarea produselor si serviciilor.

Co-designul implica:

➔ părțile interesate (utilizator final, parteneri academici, designeri, industrie);
➔ generează idei noi și concepte prin colaborarea dintre părțile interesate.



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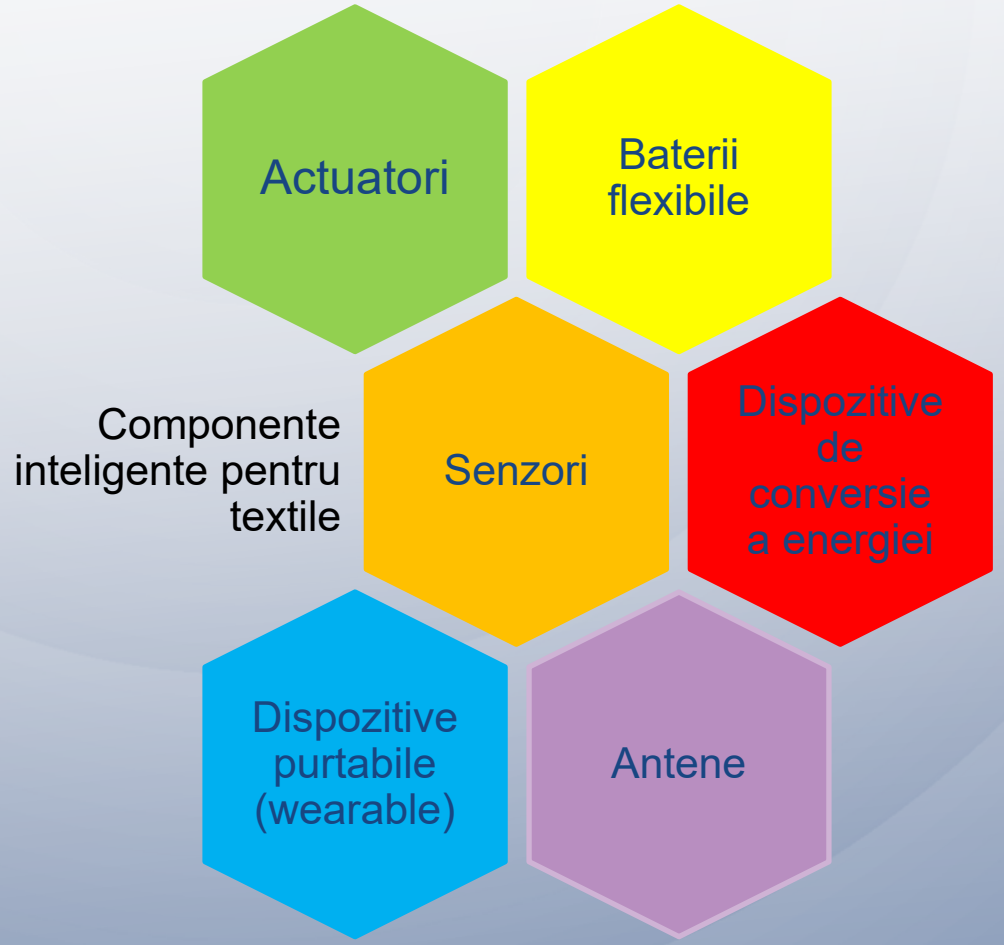
Metode creative pentru co-designul componentelor inteligente

Componente inteligente pentru textile



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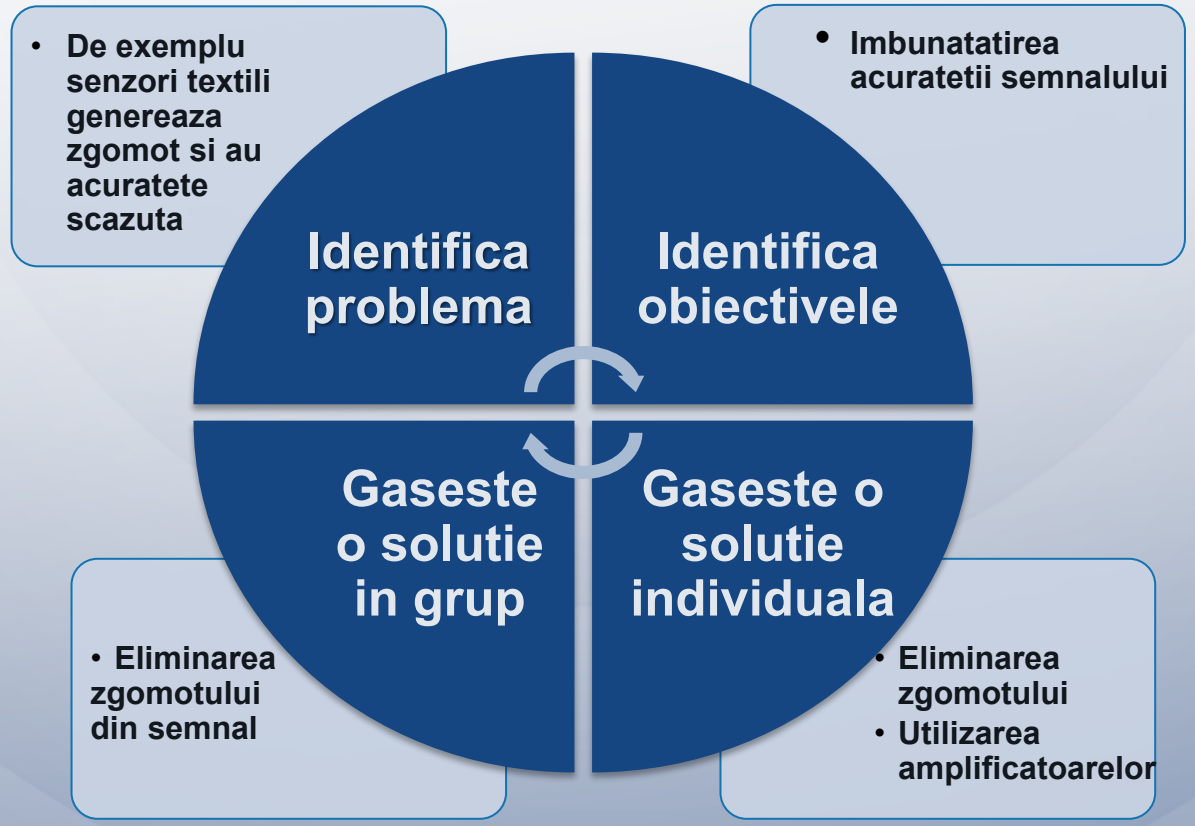
Metode creative pentru co-designul componentelor inteligente

Studiu de caz → Brainstorming



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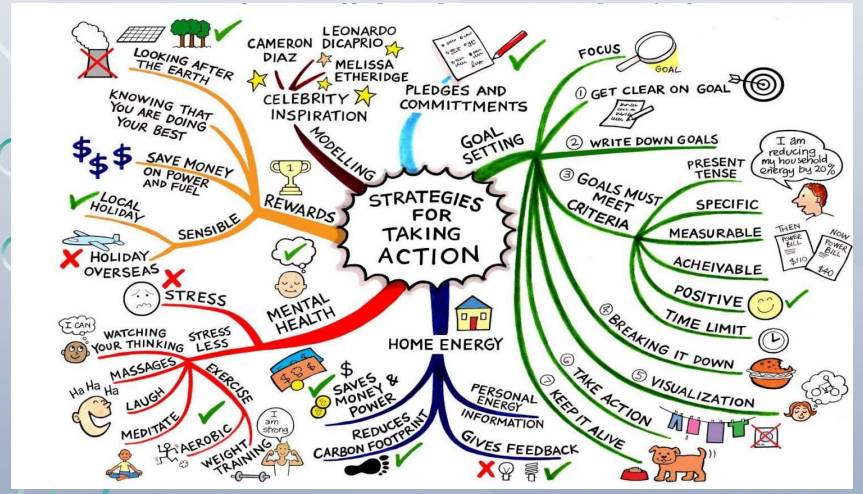
Metode creative pentru co-designul componentelor inteligente

Studiu de caz 2 ➔ Harta mintii

Harta mintii este o metodă de generare a ideilor prin asociere.
Harta mintii propusă a fost generată din ideea principală centrală (senzori portabili pentru asistență medicală) și extinsă pe direcții secundare (electrozi textili, poziție pe corpul uman) utilizand conceptele specifice despre tehnologie, materialele utilizate, pozițiile specifice de integrare a senzorilor in textile si finalizand cu senzorii specifici in functie de zona corpului.

- *Harta mintii a fost generate utilizand aplicatia software mindmeister disponibila online [2]*



Harta mintii ‘Strategii pentru schimbarile climatice’ Essay Topic [3]

DigiTex Harta mintii [1]

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Metode creative pentru co-designul componentelor inteligente

Studiu de caz 3 ➔ Cubul creativ

Corespondenta numerelor:

Tehnologii:

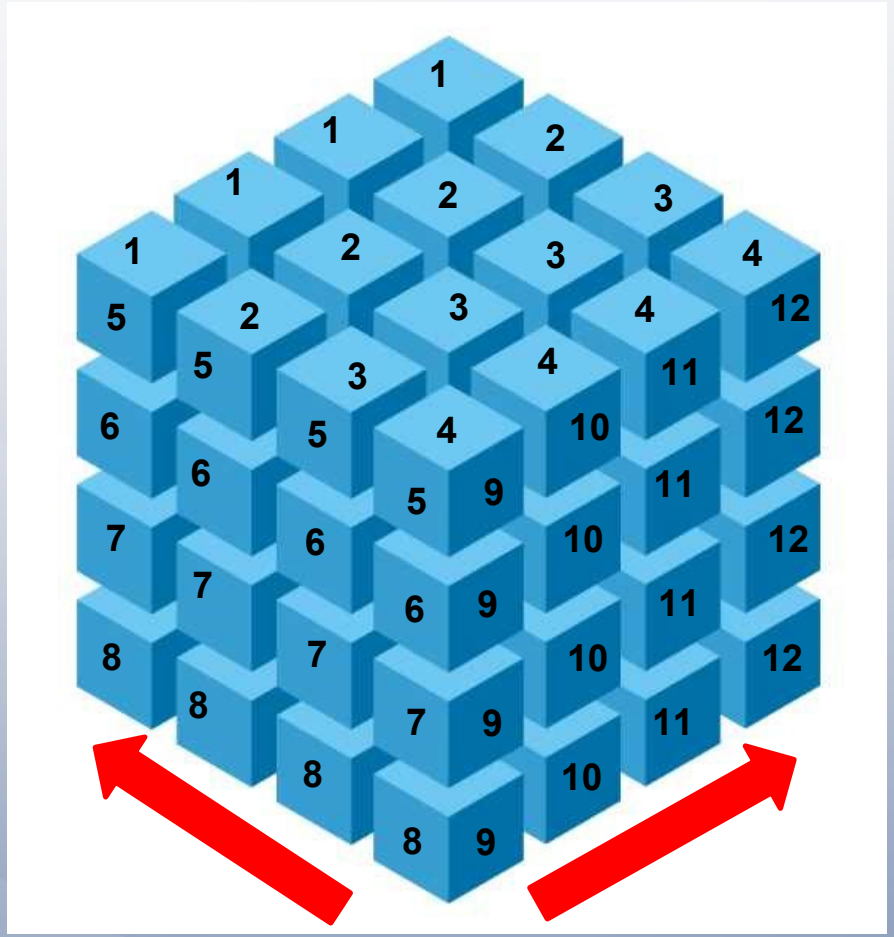
1- imprimare 3D
2-laminare
3-ultrasonare
4-serigrafie

Componente:

5-senzori
6-actuatori
7-baterii
8-dispozitive de conversie a energiei

Materiale:

9 – tricot
10 – testaura
11 – netesut
12 – impletitura



Perechi:

4-5-9 ➔ Senzori obtinuti prin metoda serigrafiei pe structura tricotata;
1-5-9 ➔ Senzori obtinuti metoda imprimarii 3D pe structura tricotata;
8-9-1 ➔ Dispozitive de conversie a energiei obtinute prin imprimare 3D pe structura tricotata;
7-9-3 ➔ Baterie obtinuta prin ultrasonare pe structura tricotata.

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Metode creative pentru co-designul componentelor inteligente

Studiu de caz 4 ➔ Laboratorul interactiv

➔utilizarea facilitatilor laboratorului interactive pentru simularea virtuala
➔grupuri de lucru, de ex.:
Grupul 1: integrarea componetelor pentru monitorizare in echipamanetele de protectie personala pentru pompieri
Grupul 2: Integrarea senzorilor in sisteme de dispozitive purtabile pe baza de textile;
Grupul 3: Integrarea componentelor de monitorizare in echipamente de protective personala pentru risc chimic;
Grupul 4: Integrarea componentelor de monitorizare in costumele pentru militari.

Pași necesari pentru co-design:

- ➔ Discuție despre cum ar trebui să fie produsele finale (20 de minute)
- ➔ Discuție despre constrângerile care apar în dezvoltarea produsului (10 minute)
- ➔ Discuție despre beneficii (10 minute)
- ➔ Definirea unei schițe a produsului textil cu componente electronice integrate (10 minute)
- ➔ Efectuați o simulare virtuală a componentelor și produselor integrate (45 de minute)
- ➔ Definirea limitelor si punctelor slabe ale produsului final (15 minute).
- ➔ Definiți posibilitatea de re-proiectare și optimizare a produsului propus (10 minute).

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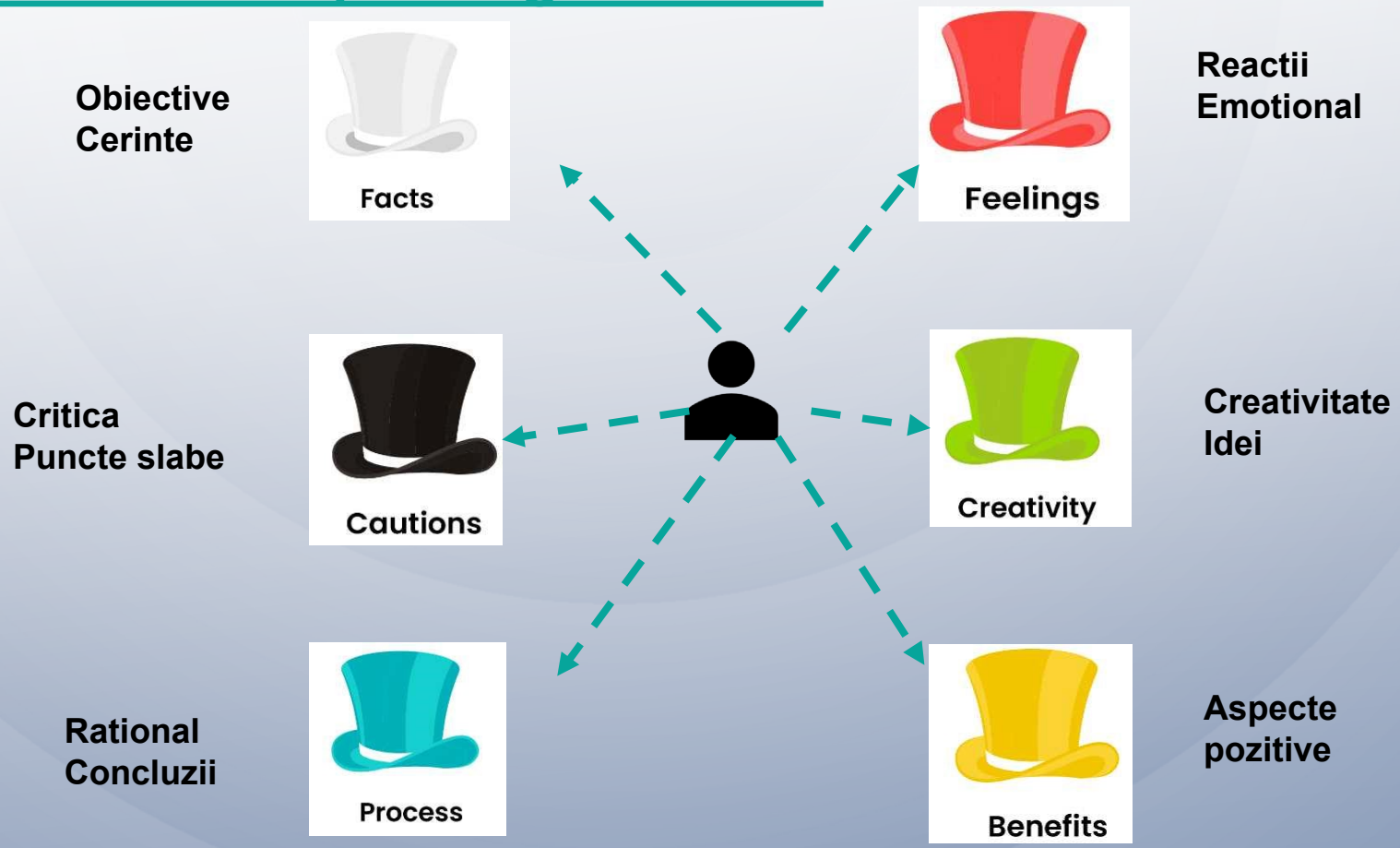
Metode creative pentru co-designul componentelor inteligente

Studiu de caz 4 ➔ Sase palarii ganditoare



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- [3] www.agile-moose.com/debonos-6-hats
- [4] www.innovolo-group.com/misc/how-you-can-use-edward-de-bonos-six-hats-method-for-exceptional-problem-solving

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DIGITEX

Dispozitive purtabile

Autori: Ioannis Chronis, Georgios Priniotakis, Athanasios Panagiotopolous

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Cuprins

- Evolutia dispozitivelor purtabile
- Generatii de dispozitive purtabile
- Un model de design efficient pentru dizpozitiv purtabil
- Concluzii

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Tipuri de dispozitive purtabile

Electronice aproape de corpul uman	Electronice pe corp	Electronice in corp	Textile electronice
Dispozitive si componente electronice in apropierea organismului uman si nu vin in contact cu corpul uman	Dispozitive si componente electronice care sunt in contact direct cu suprafata corpului uman	Dispozitive si componente electronice situate in corpul uman	Tesaturi sau textile pe baza de componente sau dispozitive electronice

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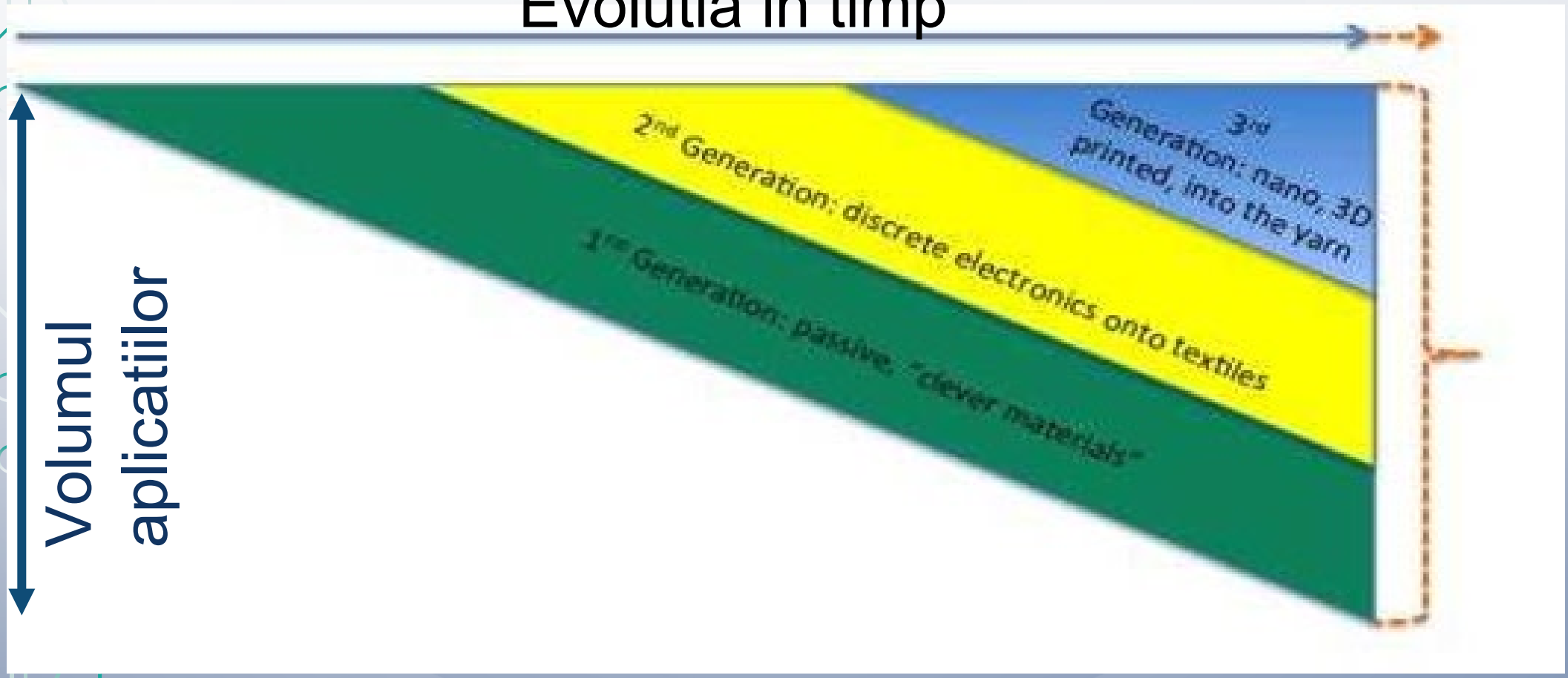
Evolutia textilelor inteligente



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Prima generatie de dispozitive purtabile

Material cu functionalitati deosebite care reactioneaza la stimuli din mediu.
Se caracterizeaza printr-o functie simpla pasiva.

Exemple tipice:
Materiale cu schimbare a fazei
Materiale cromice
Polimeri cu memoria formei
Fibre optice

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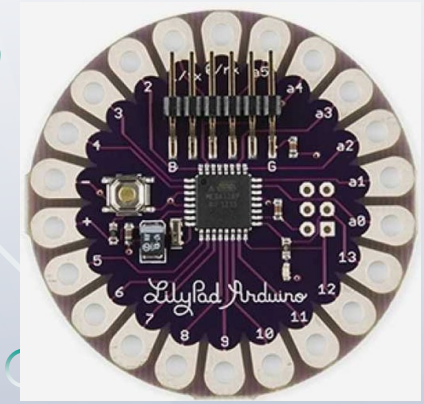
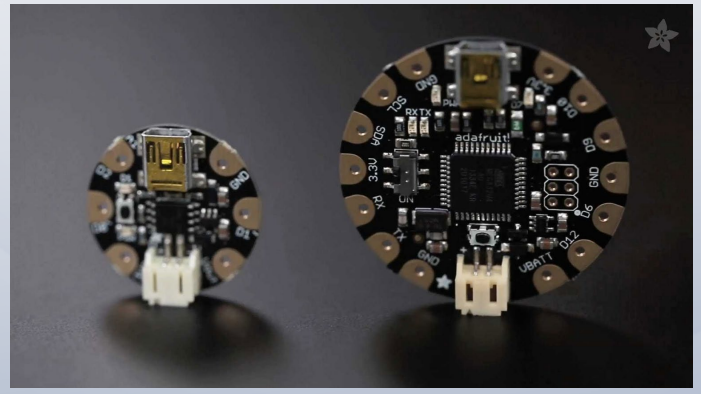
A doua generatie de dispozitive purtabile



adafruit®



ARDUINO®

shimmer®
DISCOVERY IN MOTION

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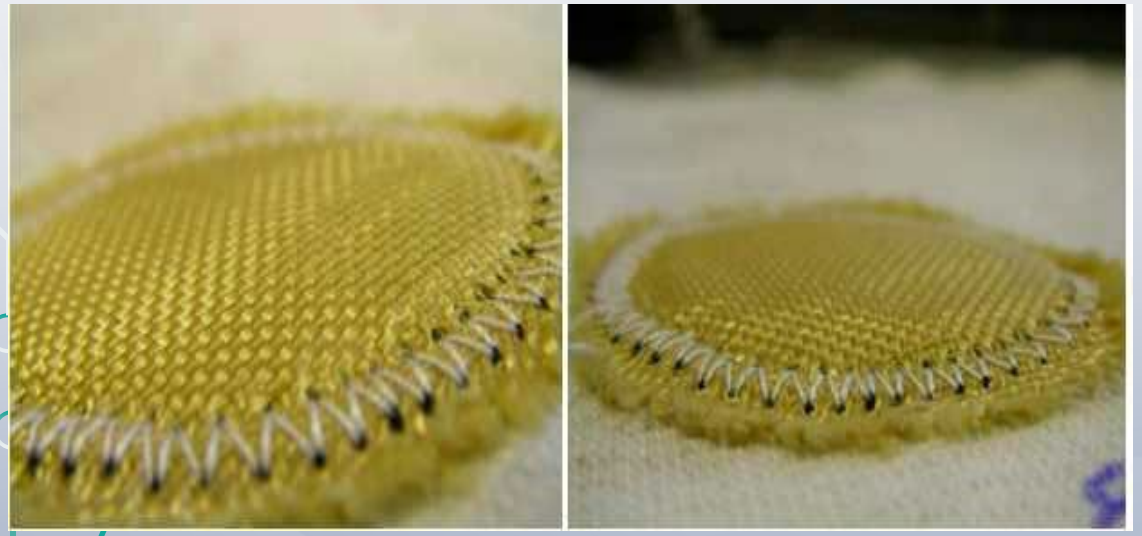
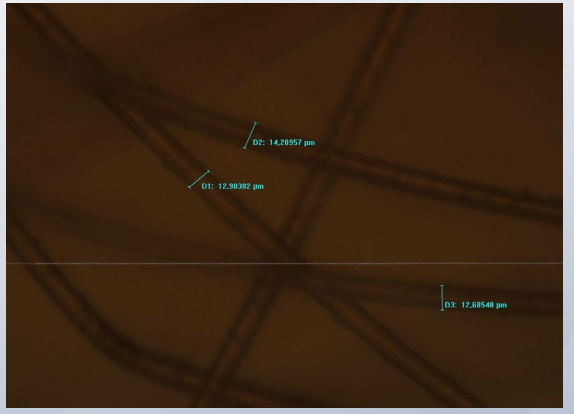
A treia generatie de dispozitive purtabile

Electrozi textili (depuneri pe baza de aur)



Imagini microscop



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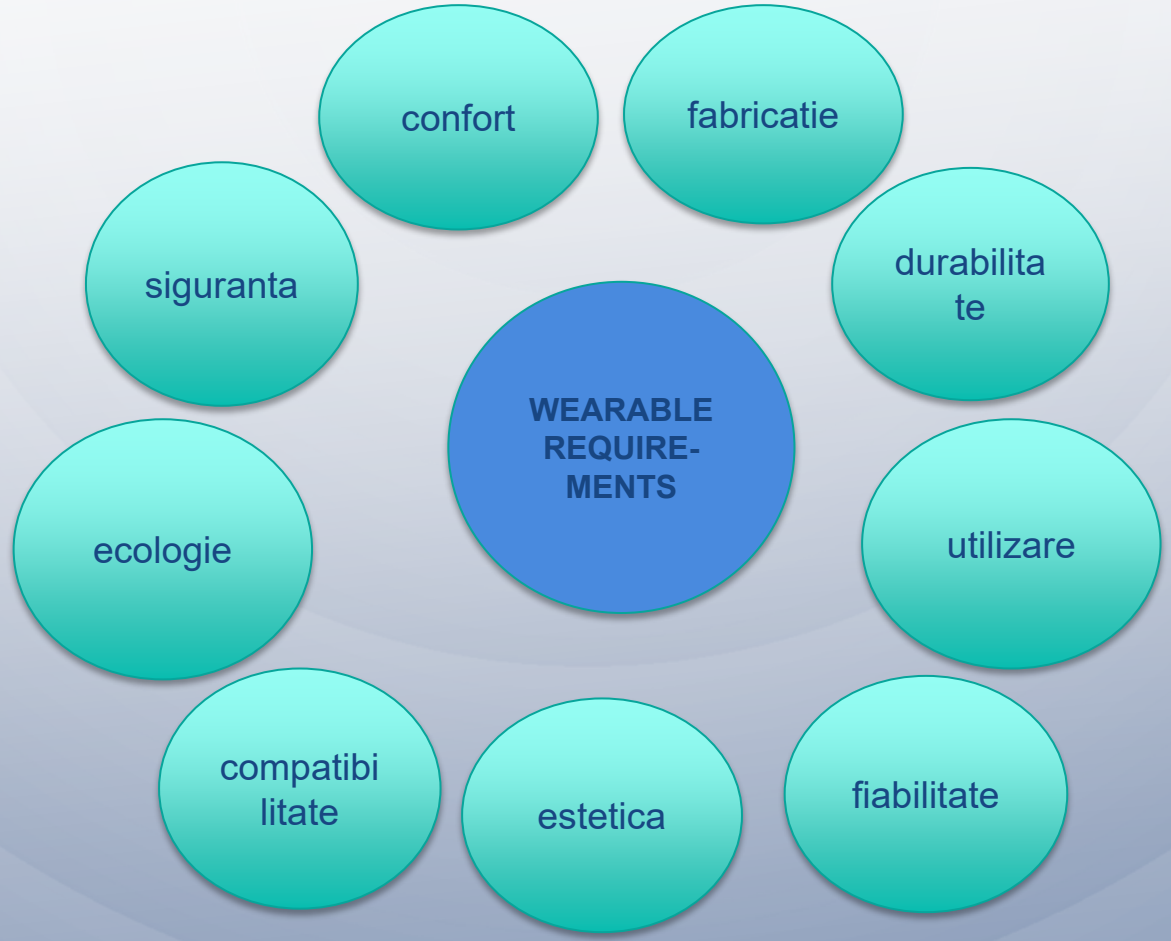
Problema integrarii



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Concluzii

- Se asteapta ca dispozitivele purtabile sa reprezinte o piață matură, deși integrarea eficientă a articolelor de îmbrăcăminte și a elementului de funcționare nu este încă foarte bine abordată.
- Aplicatiile sunt promitatoare si foarte atractive pentru utilizatori
- Proiectarea produselor purtabile este complicate si necesita abordare multidisciplinara. Designerii de moda si electronice, ar trebuie sa aiba o viziune si intelegere comuna a acestor produse;
- Se asteapta ca a treia generatie de dispozitive purtabile sa resolve aceste discrepante.

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Ecodesign pentru materialele inteligente in contextual economiei circulare

Autori: David Gómez i Maurel, AEI Tèxtils

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Cuprins

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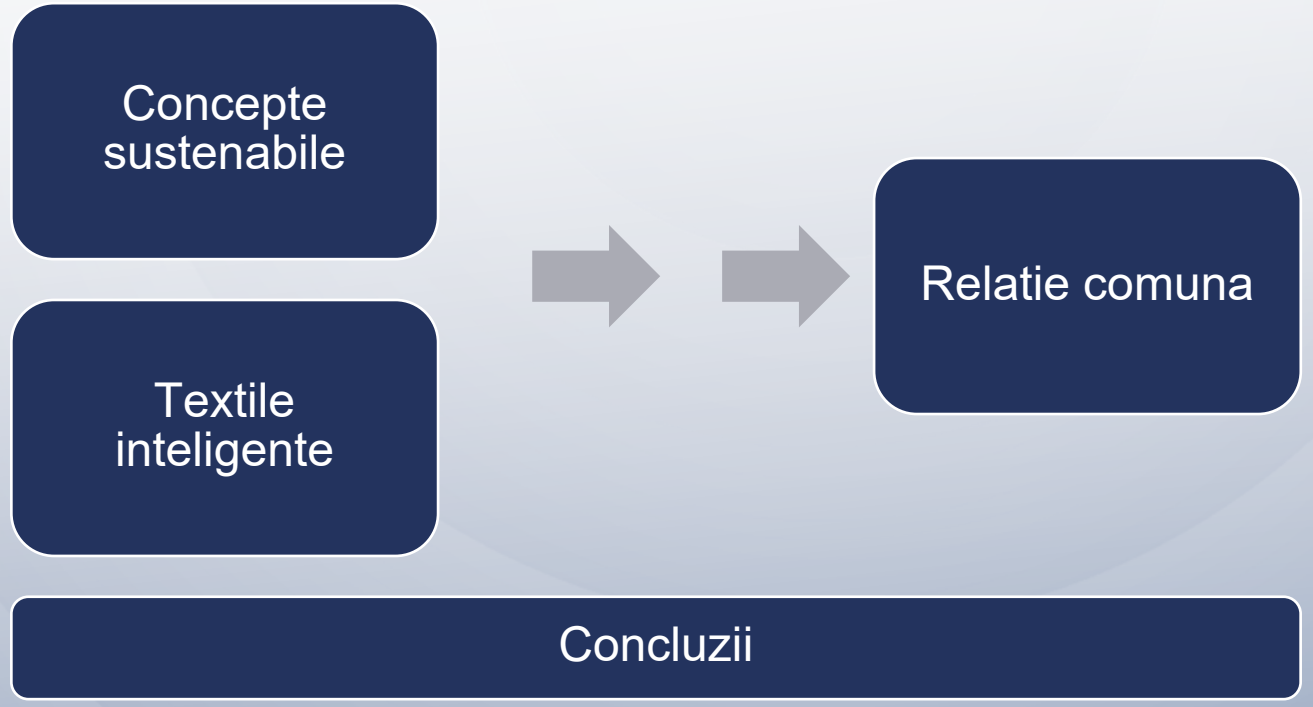
Introducere



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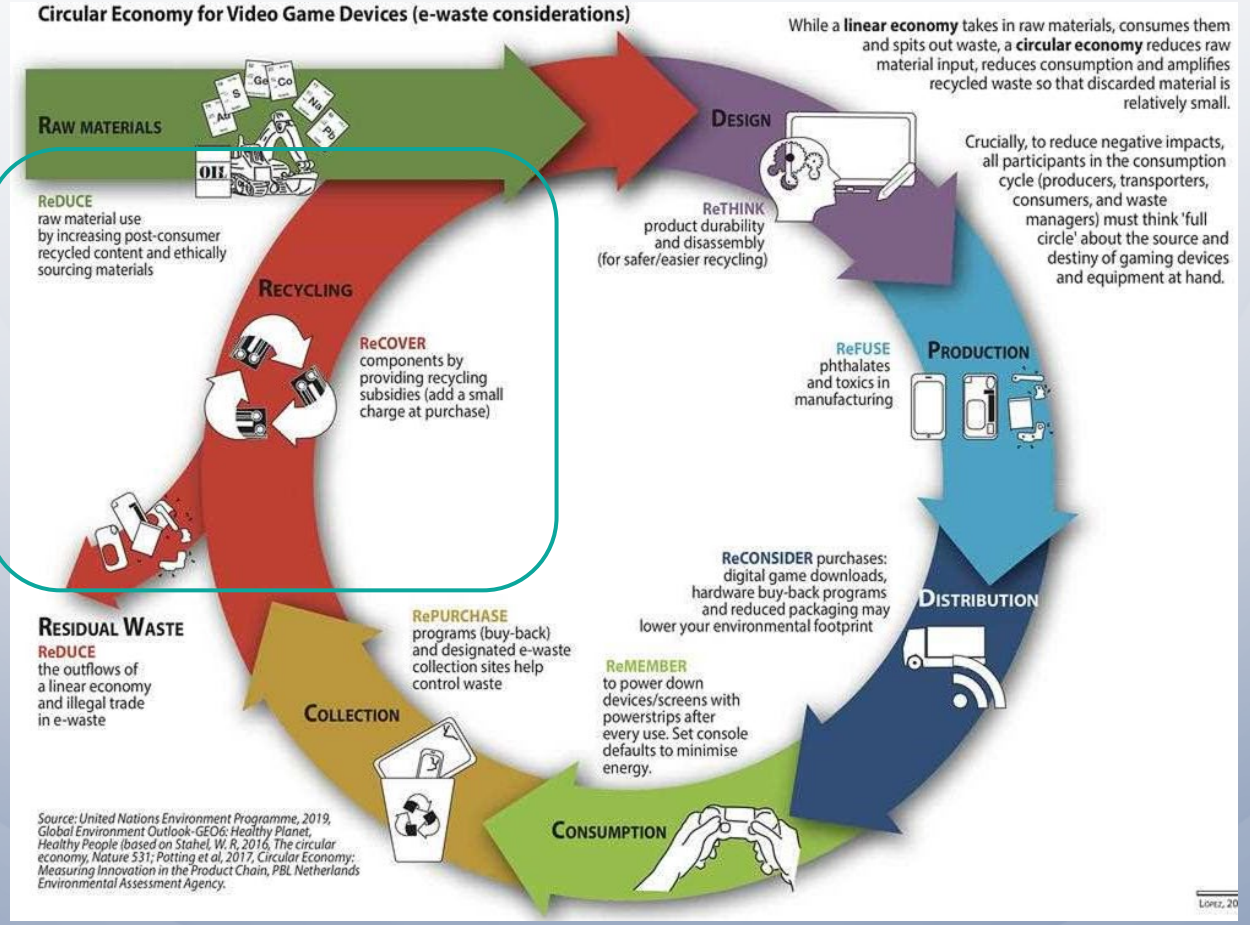
Economie circulara



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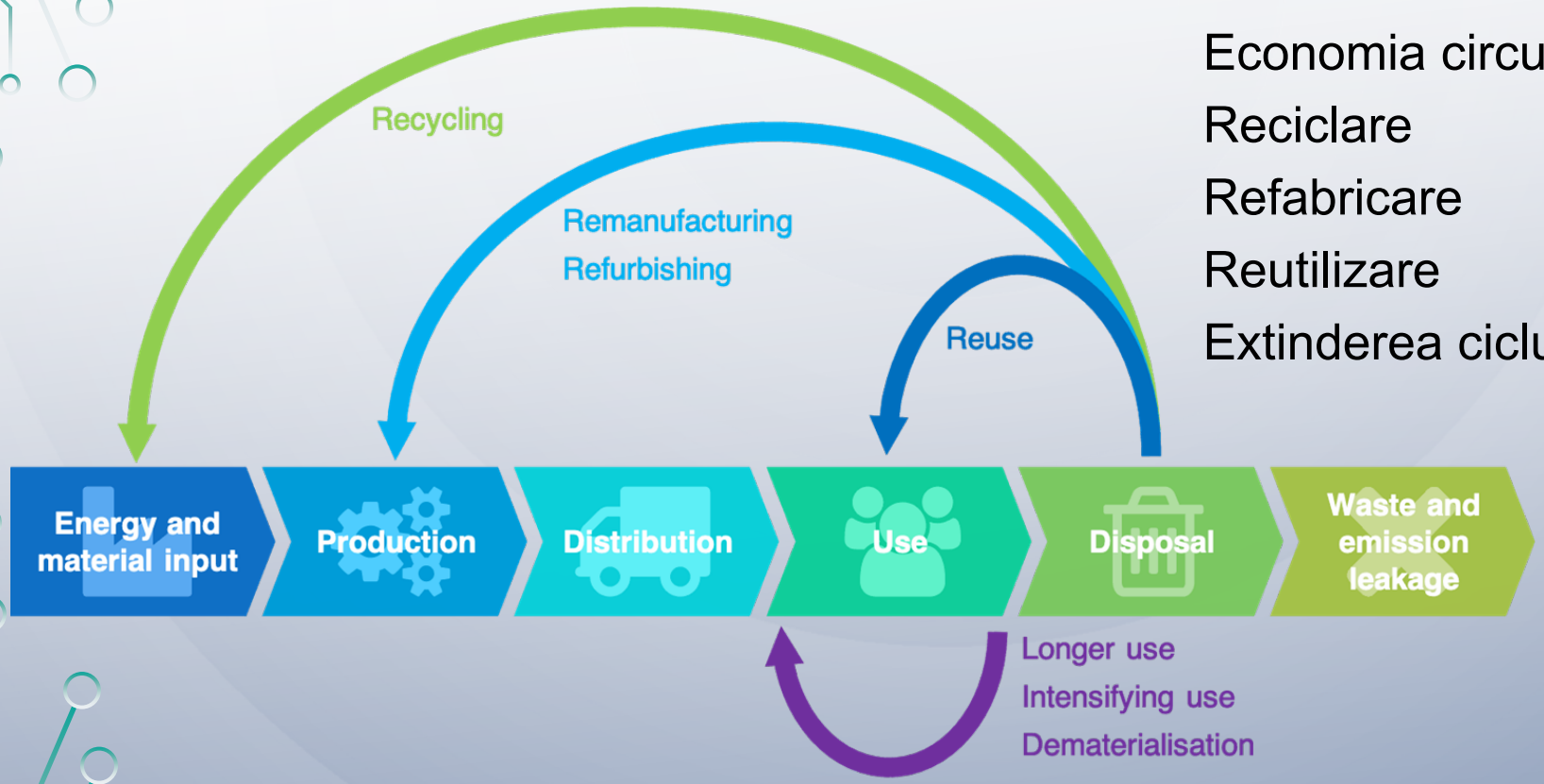
Economie circulara



Economia circulara consta in:

Reciclare

Refabricare

Reutilizare

Extinderea ciclului de viata al produselor

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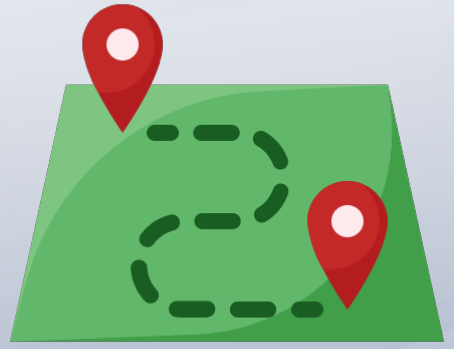
Ecodesign

Principiile ecodesignului

Performanta



Internationalizarea costurilor

Viziune cuprinzătoare asupra ciclului de viață

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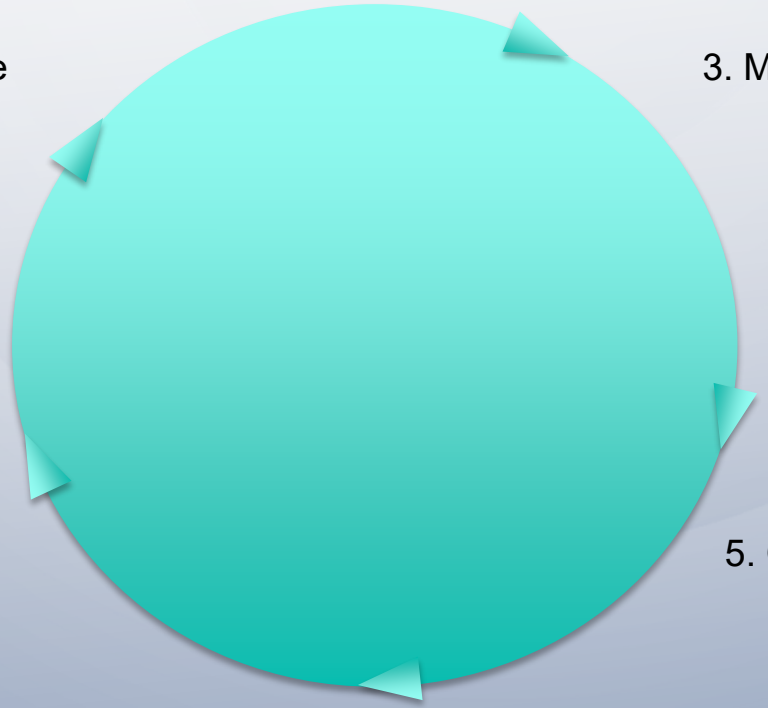
Ecodesign

2. Reducerea consumului de materiale

1. Noi concepte de dezvoltare

3. Materiale cu impact redus asupra mediului



8. Optimizarea sfarsitului ciclului de viata

4. Reducerea impactului producției asupra mediului

7. Extinderea duratei de utilizare

5. Optimizarea distributiei

6. Reducerea impactului de mediu in timpul utilizarii

Sursa: Brezet, H; van Hemel, C. 1997

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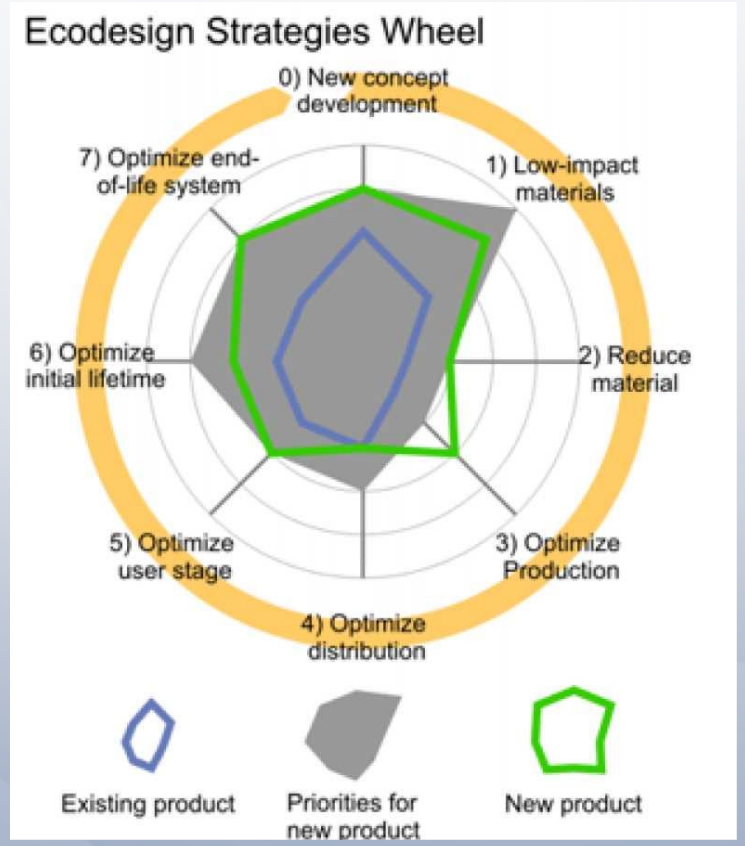
Ecodesign

LCA



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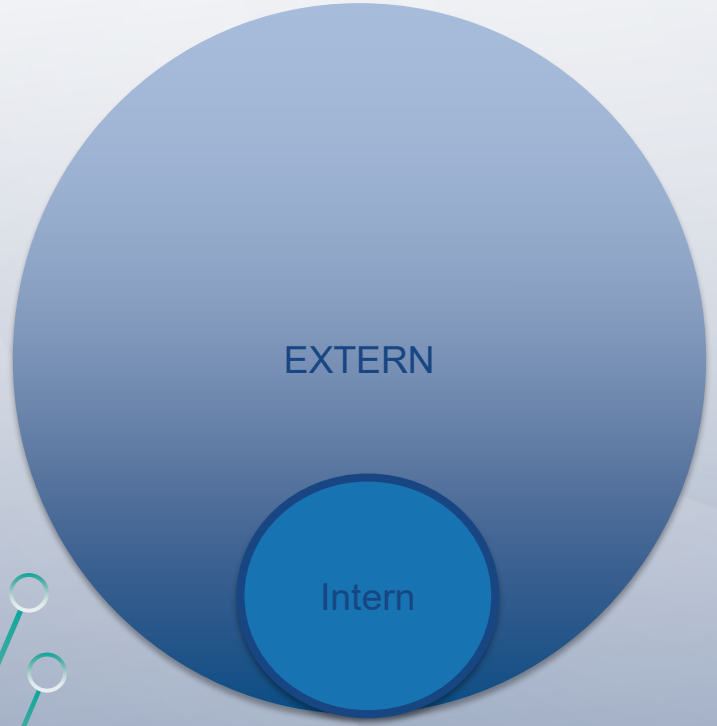
Ecodesign

Beneficiile ecodesignului



- Reducerea costurilor de producție și distribuție
- Satisfacerea cererii consumatorilor
- Cerințe specifice în diferite țări pentru importul anumitor produse
- Respectarea legislației de mediu, anticiparea schimbărilor viitoare
- Angajamentul companiei față de mediu și durabilitate
- Creșterea valorii adăugate și a calității produsului (durabilitate, funcționalitate)
- Posibilitatea de a utiliza sisteme de etichetare ecologică
- Posibilitatea de a avea acces la noi piețe pentru achiziții ecologice

- Reducerea costurilor de producție și distribuție
- Evaluarea internă a întregului ciclu de viață al produsului
- Analiza configurațiilor alternative bazate pe ciclul de viață al produselor
- Referinte pentru reducerea impactului produsului
- Obtinerea rezultatelor cuantificate conform metodologiilor standardizate: TRANSPARENTA

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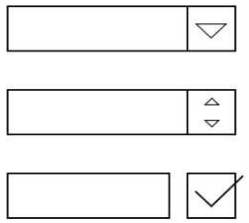
Ecodesign – instrumente virtuale

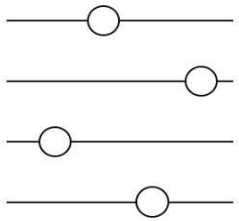
Calculator indice de circularitate

step 1
define the product



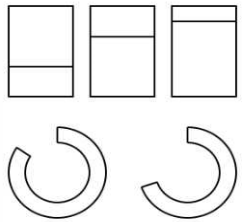
Describe components, materials, masses and costs, or import an existing Bill of Materials

step 2
adjust the cycles

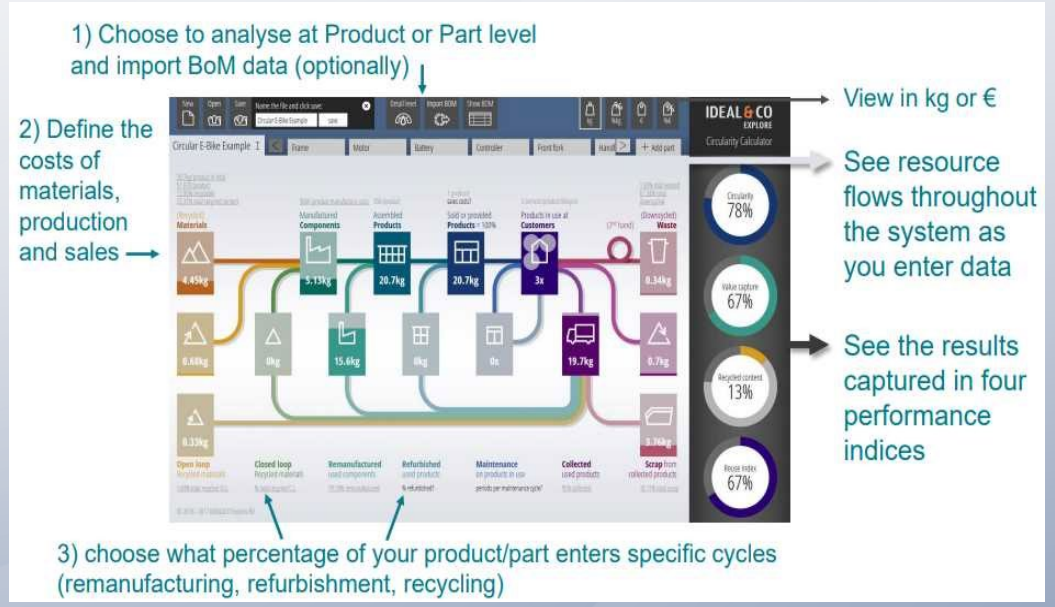


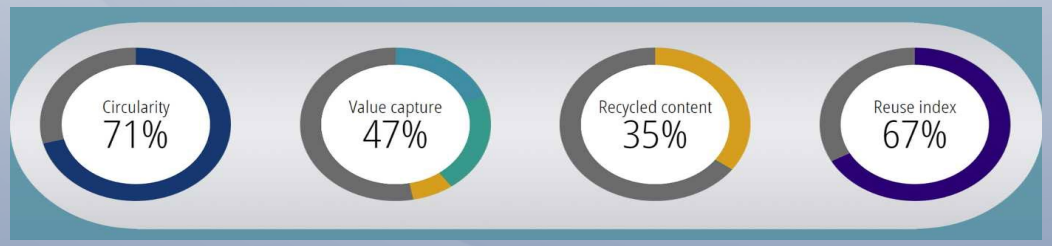
Try different reuse options, collection rates or materials, and see the effects immediately

step 3
compare strategies



Choose design options and business models by comparing circularity and value capture





Calculator indice de circularitate

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Ecodesign – instrumente digitale

Hoskins – ***Calculator pentru calcularea indicelui de circularitate al materialelor***

Instrument Hoskins

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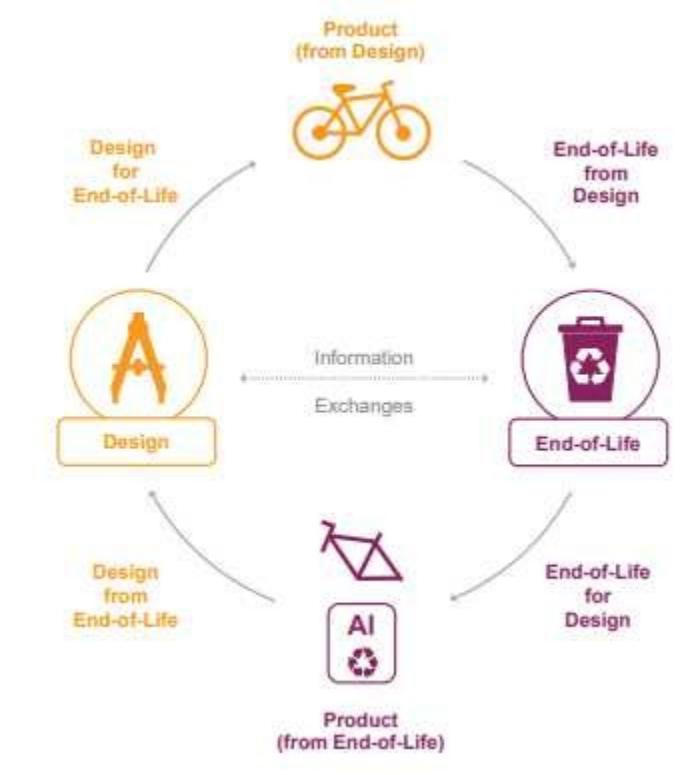
Rolul ecodesignului in economia circulara



Sursa: O abordare circulara a ecodesignului pentru imbunatatirea circularitatii

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Concluzii

- Economia circulară este solutia pentru optimizarea tuturor tipurilor de resurse (materiale, energie, resurse naturale și mediu);
- Exista studii si inițiative care completează și extind sistemul economiei circulare;
- Sfârșitul duratei de viață a unui produs este pasul cheie pentru reintroducerea lui într-un sistem circular;
- Designul ecologic este esențial pentru a facilita reciclarea produselor;
- Designul ecologic este esențial pentru extinderea duratei de viață a produselor;
- Sistemul actual nu este încă pregătit corespunzător, existand limitări pentru proiectarea ecologică;
- Instrumentele digitale devin esențiale pentru a analiza și îmbunătăți circularitatea produselor.

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Integrarea sistemelor purtabile si algoritmi

Autor: Aileni R.M., INCDTP, Bucuresti, Romania

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Cuprins

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Integrarea sistemelor purtabile si algoritmi

- Bratara pentru jocuri
- Incaltaminte inteligenta
- Fitness Tracker
- Imbracaminte inteligenta
- Ochelari inteligenti
- Banda pentru monitorizare GPS
- Manusa inteligenta
- Inel inteligent

Manusa inteligenta[7]

Myo bratara pentru controlul gesturilor[1]

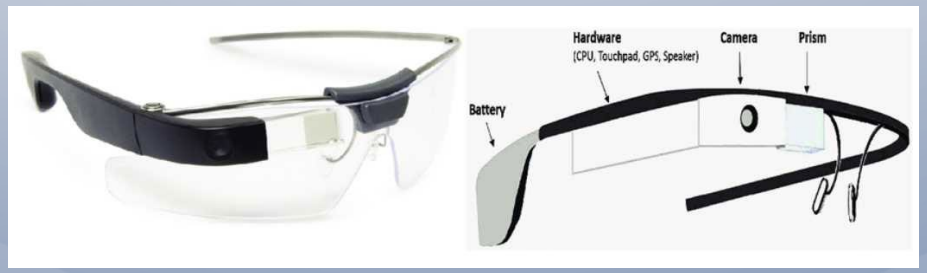
Incaltaminte inteligenta (senzori de presiune, GPS) [2]

Garmin centura pentru monitorizare puls, GPS [6]

Inel inteligent [8]

Bratara Fitness (Puls, SPO2, Temperatura, Pasi)

Ochelari inteligenti [5]



Imbracaminte inteligenta (ECG) [4]

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Integrarea sistemelor purtabile si algoritmi

Integrarea dispozitivelor purtabile:
1. Prin utilizarea PCB avand toate componentele rigide integrate si suport textil (Integrare Hard)
2. Prin utilizarea materialelor textile cu fire conductive sau depuneri conductive (avand rolul electrozilor)
+ microcontrolere + Bluetooth (Integrare Soft-Hard)

Algoritmi se utilizeaza pentru sisteme inteligente in:
-achizitia datelor utilizand consum minim de energie;
-procesarea semnalelor
-extragerea informatiei utile din datele digitale pe baza algoritmilor, data mining si inteligenta artificiala (machine learning, deep learning)
-analiza corelatiilor intre diferite semnale pentru a stabili tiparele adecvate pentru recunoasterea starii medicale.

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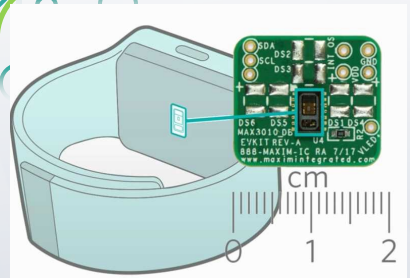
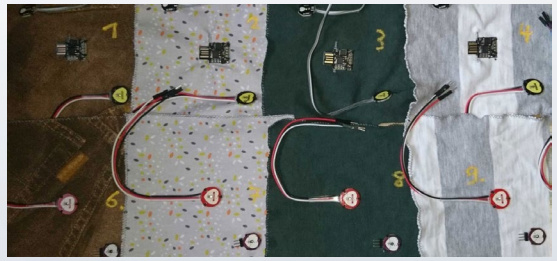
Integrarea sistemelor purtabile si algoritmi

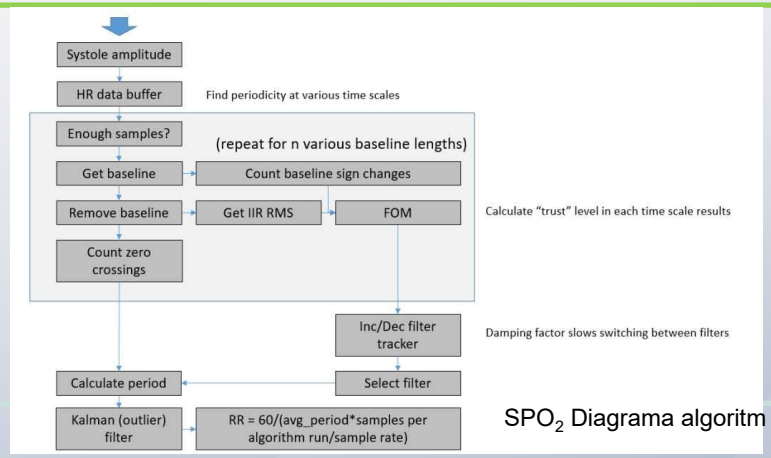
Studiu de caz 1 ➔Monitorizare Puls /SPO2 prin dispozitive purtabile



Integrare pulsoximetru [9]



Integrare senzori pentru Puls/SPO2 [10]



SPO_2 Diagrama algoritm [11]

Integrare

➔ **În textile pot fi integrate componente dure (senzori de puls/SPO2 prin coasere sau lipire cu adezivi)**

Algoritmi

Semnale initiale ➔ preprocesarea datelor cu ajutorul filtrului Savitsky-Golay (SG) pentru eliminarea zgomotului;
➔ Utilizarea algoritmului pentru detectia ritmului cardiac implica următoarele metode:
1. Metoda (filtru) trece banda
2. Metoda ferestrei
3. Metoda fuziunii

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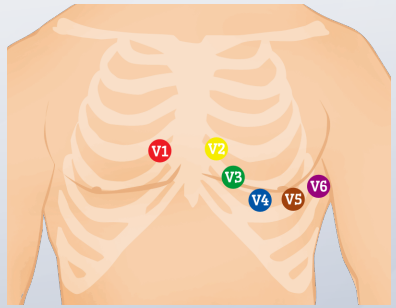
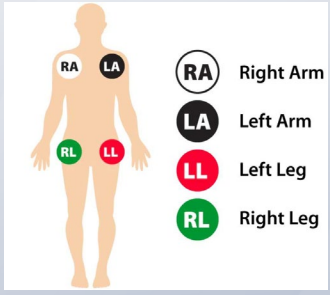
Integrarea sistemelor purtabile si algoritmi

Studiu de caz 2 ➔ monitorizarea activitatii electrice a inimii (ECG)

Imbracaminte cu 3 derivatii ECG [12]





Pozitionarea celor 12 derivatii ECG - Electrozi toracici și membre [13]

Integrarea

➔ In textile pot fi integrate componente flexibile (electrozi ECG realizati prin integrarea firelor conductoare în suport textil (tricot, structură țesută) și acoperire conductivă pe bază de microparticule metalice.

Algoritmi

Activitatea electrică a inimii umane (ECG) constă din mai multe forme de undă (P, QRS și T) [14].
Algoritmii pot detecta vârfurilor (PEAK), panta (SQRS) și Length-Transform (WQRS) [15].
Sunt propuși algoritmi precum TERMA care exploatează mediile mobile legate de două evenimente și transformarea Fourier fracțională [14].

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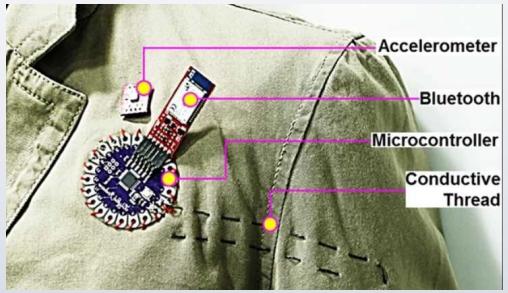
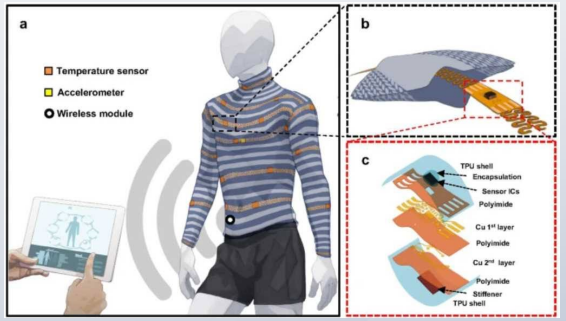
Integrarea sistemelor purtabile si algoritmi

Studiu de caz 3 ➔ Monitorizarea caderii cu dispozitive purtabile



Imbracaminte cu accelerometru integrat[16]



Imbracaminte confortabila cu sisteme de monitorizare wireless (E-TECS) [17].

Integrare

➔ In textile pot fi integrate componente rigide cum ar fi acelerometru cu 3 axe, magnetometru.

Algoritmi

Algoritmul de detectare a căderii utilizeaza accelerația pe 3 axe poate utiliza:
-o combinație cu Simple Threshold și Retele Markov Ascunse[18];
-algoritmul k- Nearest Neighbours [19];
-Algoritmul de detecție a căderii pe baza învățarii profunde [20].

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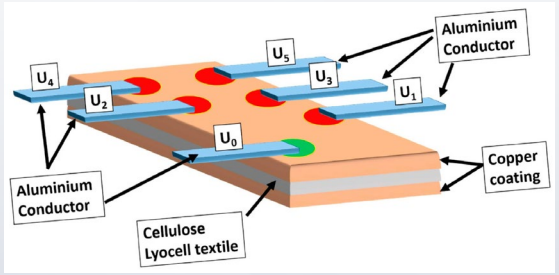
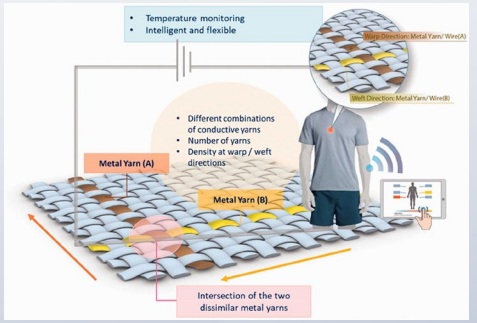
Integrarea sistemelor purtabile si algoritmi

Studiu de caz 4 ➔ Monitorizarea temperaturii cu dispozitive purtabile



Material textil acoperit cu cupru prin tehnica magnetron sputtering, si utilizat ca suprafata conductoare pentru masurarea temperaturii [21].



Termocuplu tesuta [22]

Integrare

In textile pot fi integrate termocupluri realizate prin interconectarea a 2 fire sau suprafețe (A, B) din diferite metale (de exemplu, A cupru și B constantan (Cu/Ni)) obținute prin țesere, tricotare, coasere sau magnetron sputtering.

Algoritmi

Semnale initiale ➔ Preprocesarea datelor ➔ Esantionarea semnalelor [10-15 minute pentru controlul temperaturii]

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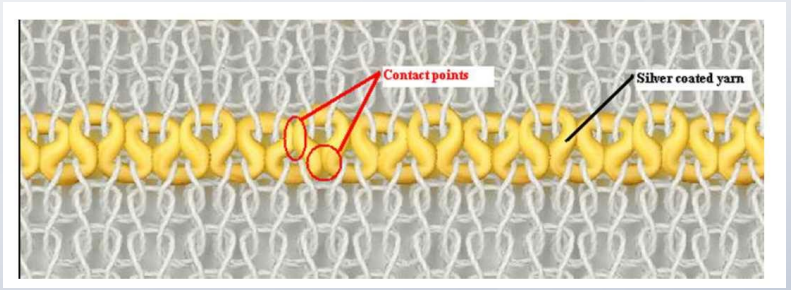
Integrarea sistemelor purtabile si algoritmi

Studiu de caz 5 ➔ Monitorizarea ritmului respirator cu dispozitive purtabile

Traductor centura pentru monitorizare respiratie [23]



Senzor tricotat pentru monitorizare respiratie [24]

Integrare

➔ In structurile textile pot fi integrate componente flexibile (centuri pentru monitorizarea ritmului respirator) folosind integrarea prin coasere sau tricotare.

Algoritmi

- filtrarea semnalelor analogice pentru eliminarea zgomotului, utilizand filtrarea mediană, transformarea wavelet și filtrarea morfologică [25];
- analiza datelor prin evaluarea raportului dintre timpul inspirator și timpul expirator in acdrul unui ciclu de respirație [25];
- clasificarea SVM a datelor ca fiind normale sau anormale [25].

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Dinamica pietei si oportunitati

Autor: Silvana Laudoni, Ciape, Rome Italy

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Introducere

Textilele inteligente reprezinta o piata cu crestere rapida. Chiar daca este un domeniu complex, unde trebuie rezolvate atat aspectele tehnologice cat si cele non-tehnologice, potentialul depaseste provocarile. Cresterea cererii de dispozitive purtabile, progresele tehnologice, progresele in domeniul nanotehnologiei și evoluțiile producției sunt factorii principalii factori care determină dezvoltarea domeniului.

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Segmentarea pietei pentru textilele inteligente

TIP

- Textile inteligente pasive
- Textile inteligente active

FUNCTIE

- Senzori
- Captarea/conversia energiei
- Luminiscenta si estetica
- Termoelectrica

DOMENIU UTILIZARE FINALA

- Militar si protectie
- Sanatate
- Sport si fitness
- Moda
- Transport
- Arhitectura

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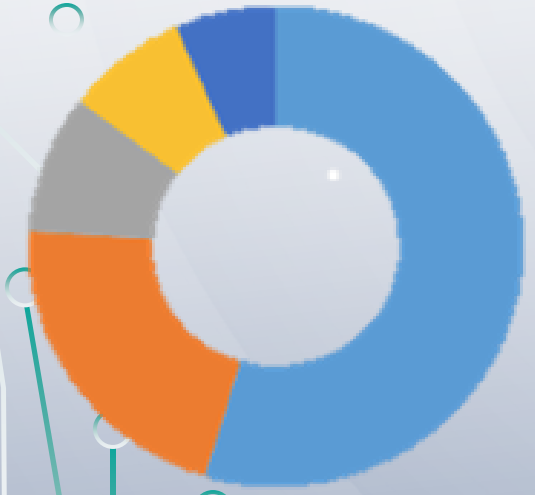
Cote de piata pe regiuni



- America de Nord
- Europa
- Asia Pacific
- Orientul mijlociu & Africa
- America de Sud

Analiza regionala in 2021 (%)

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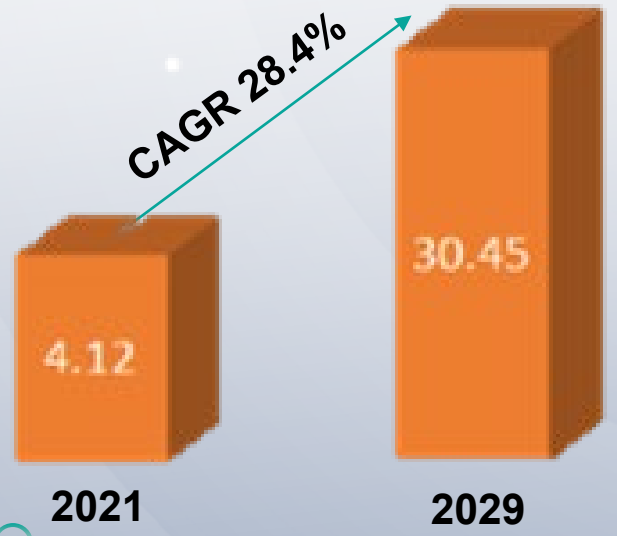
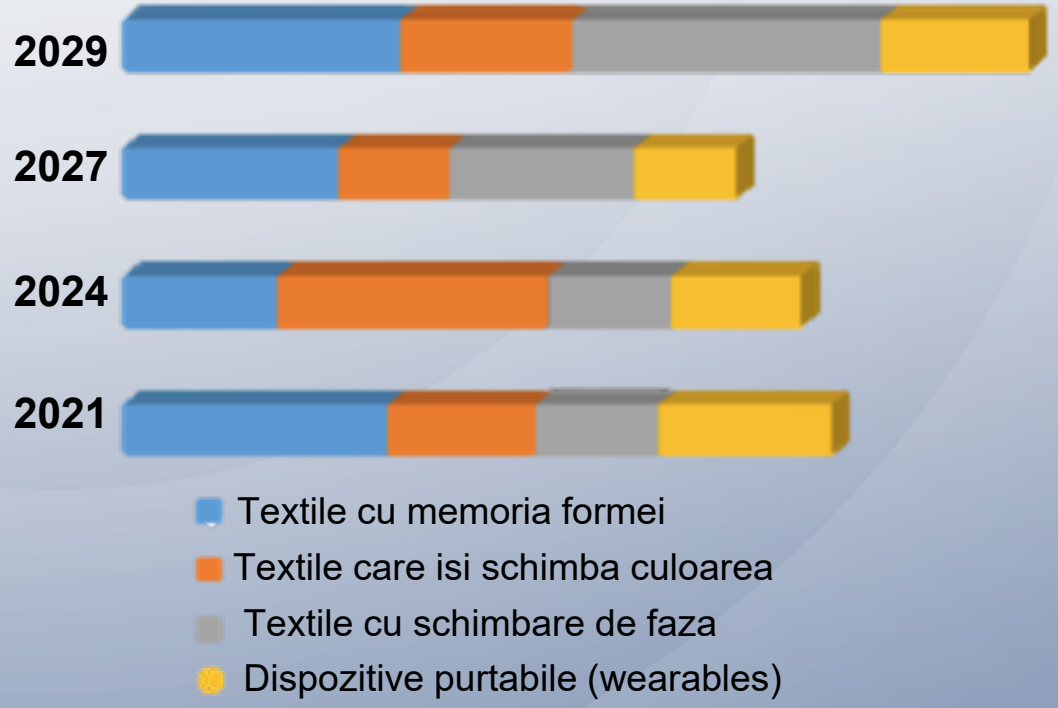
Previziuni de crestere a pietei



Dimensiunea pietei in miliarde US$



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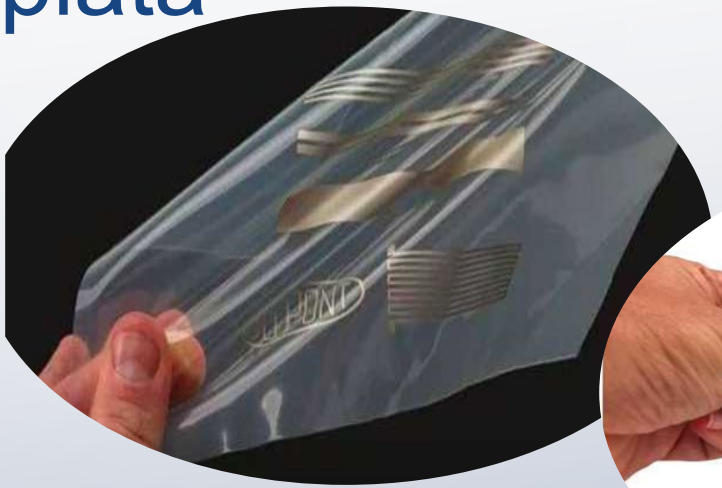
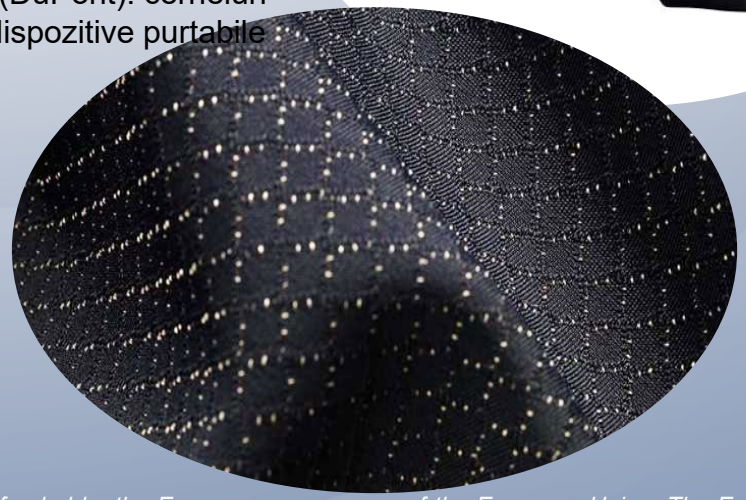
Jucatori-cheie pe piata

- DuPont
- Alphabet
- Jabil
- AIQ Smart Clothing
- Sensoria
- Adidas
- Schoeller Textil AG
- Interactive Wear AG
- Google LLC
- Ohmatex A/S



Micromax Intexar (DuPont): cerneluri extensibile pentru dispozitive purtabile (wearable)

Sensoria Smart Socks: senzori textili care detectează parametri importanți pentru performanța miscarii



Scholler e-soft: Material textile care se poate incalzi pe baza de retele de fire conductive

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Aplicatii principale

Credit: Beecahm Research
Source: SMART TEXTILES IN EUROPE: THE NEXT TECH DISRUPTION – SMARTX EUROPEAN SMART TEXTILE ACCELERATOR

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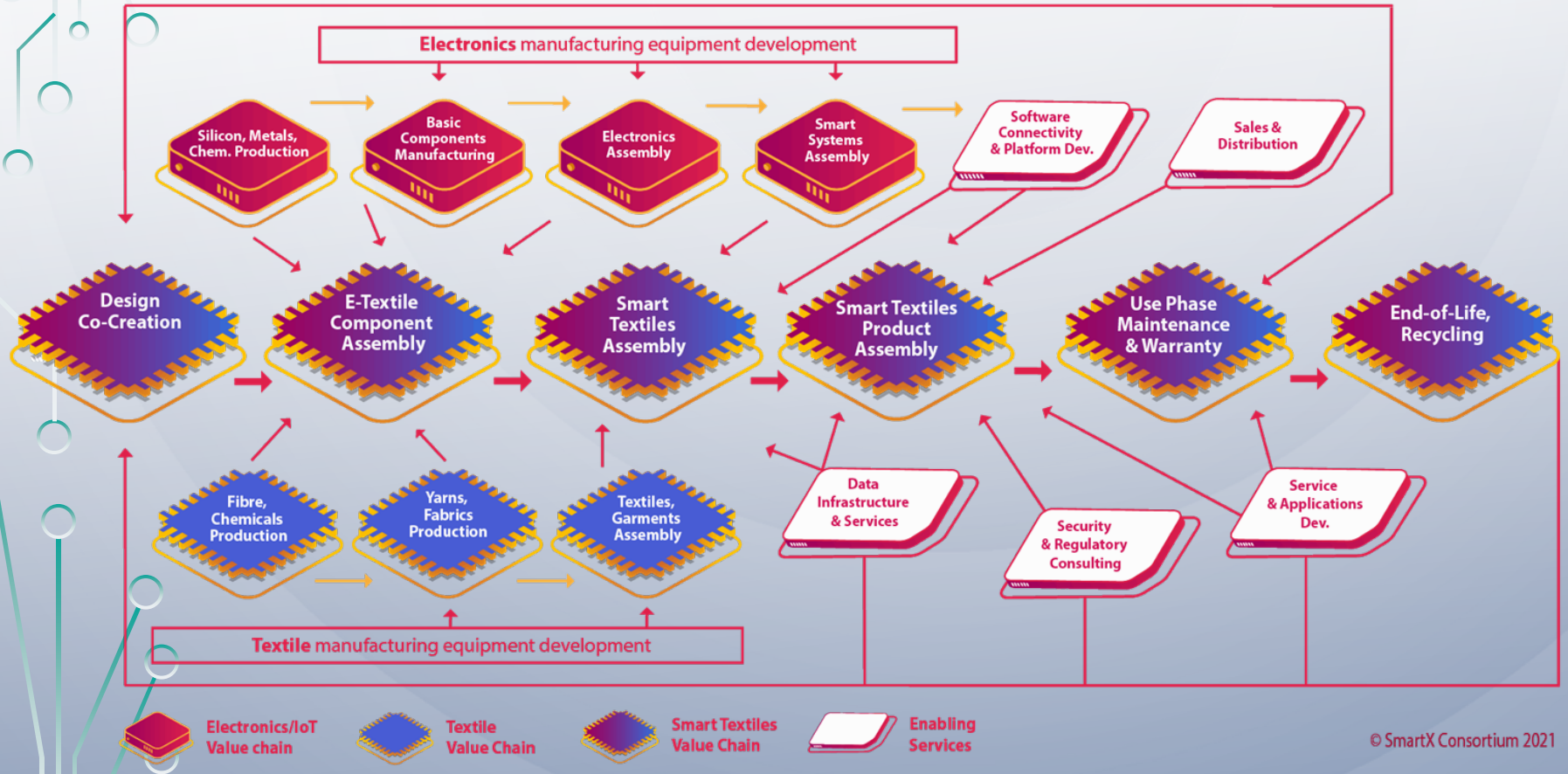
Lantul valoric pentru textilele inteligente



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Provocari pentru dezvoltarea pietei

Tehnologic	Non-Tehnologic
• Lipsa unor procese complet automatizate accesibile pentru integrarea electronicelor în textile • Nevoia de tehnologie de fabricație scalabilă și rentabilă pentru electronicele flexibile si imprimate • Necesitatea accelerarii procesului de dezvoltare în domenii cheie, cum ar fi imprimarea 3D a materialelor conductive și integrarea materialelor semiconductoare polimerice pe material textile • Intretinere si reciclare • Procesarea datelor	• Lipsa standardelor și metodelor de testare • Lipsa unor metode eficiente de cooperare între actorii ecosistemului • Lipsa unor reglementari clare • Lipsa educatiei adecvate • Nivel scăzut de conștientizare al consumatorilor

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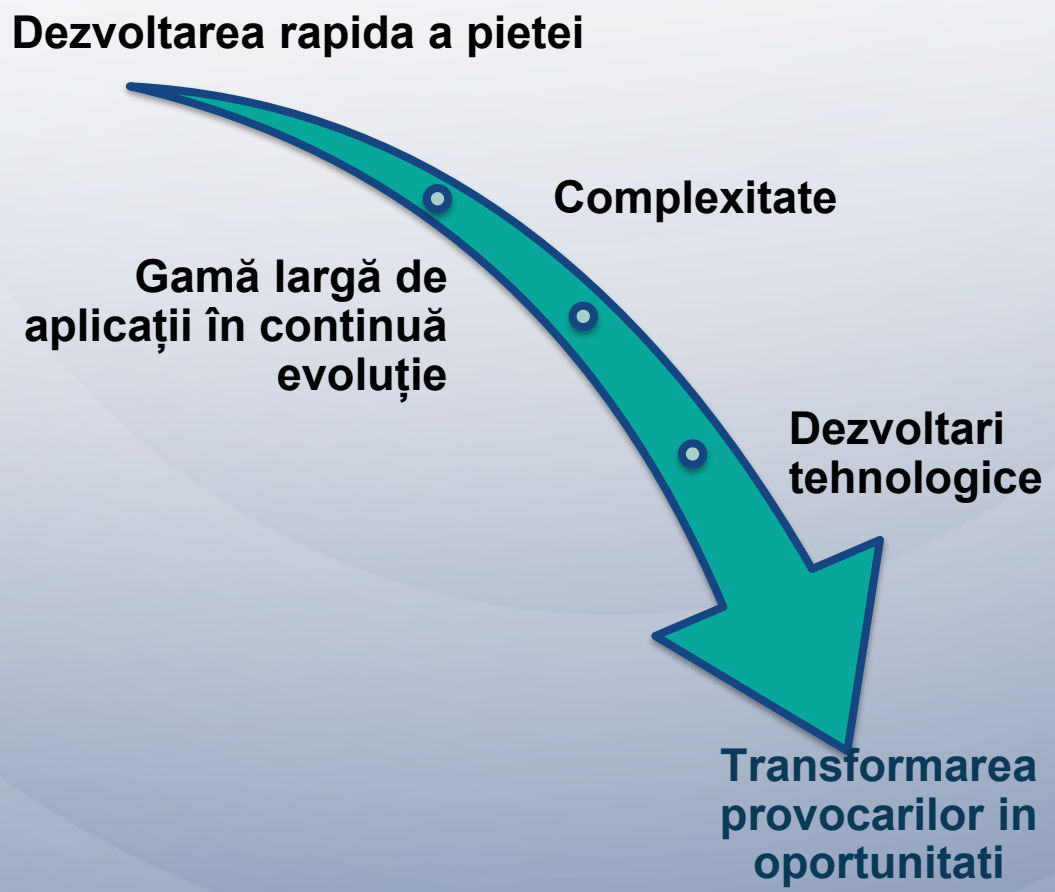
Puncte cheie



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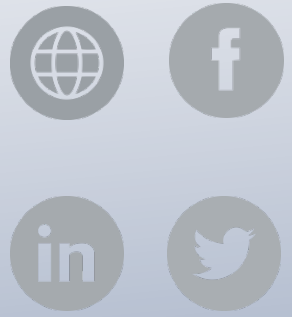

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