

Proof of concept for traceability of recycled gold using a blockchain-based digital product passport (DPP)

May 10th, 2023 | Going Green – CARE INNOVATION 2023 | Frauke Haenel



Overview

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iPoint

1 | About iPoint

We are iPoint

iPoint Facts & Figures



2001

Over 20 years of experience and know-how in the areas of compliance and sustainability



170+

Employees on 10 locations worldwide, German headquarters



GRO CAPITAL

Backed up by a strong financial partner



250

Global enterprises among customers



75,000

Users from 110+ countries

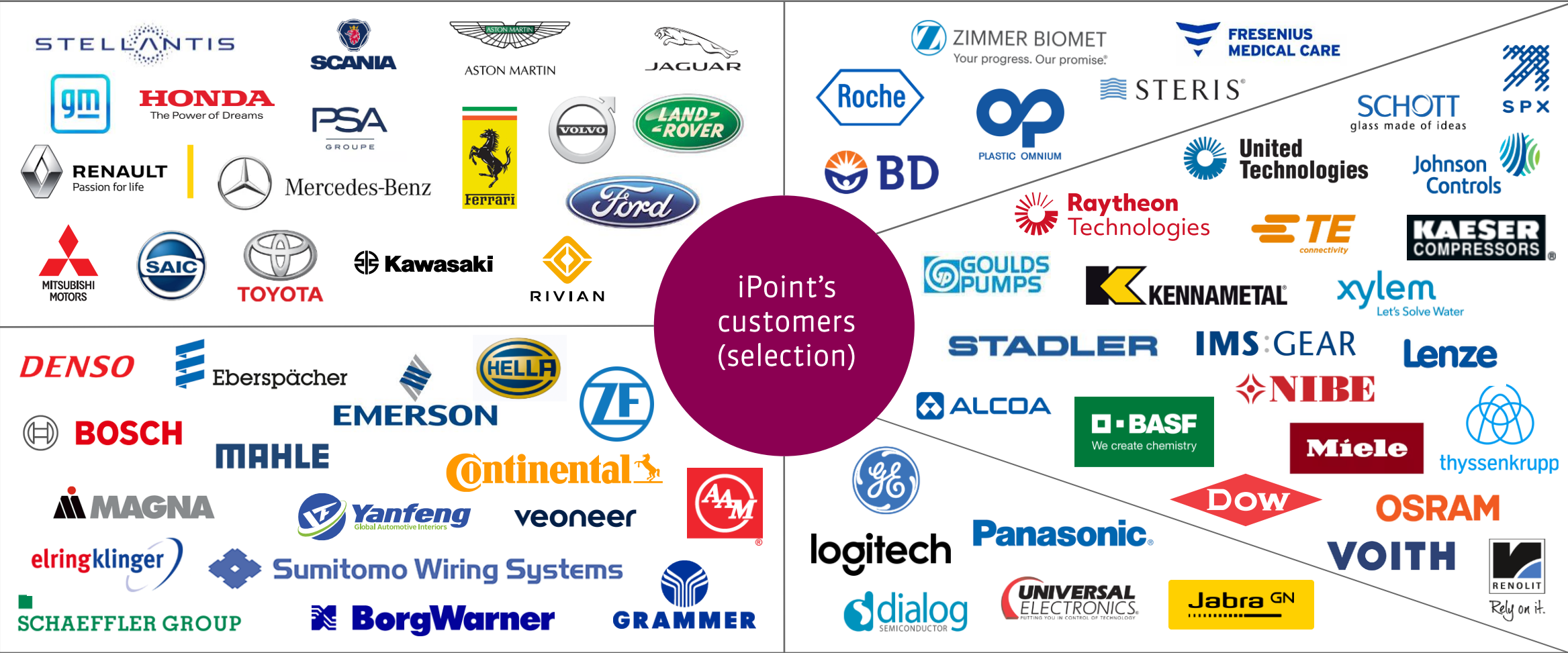


ISO & TISAX

ISO certifications: 9001, 27001
+ TISAX certification

We develop software for...

Compliance, Sustainability, and Risk Management



Future solutions: Our research & innovation projects (selection)

Digital Product Passport

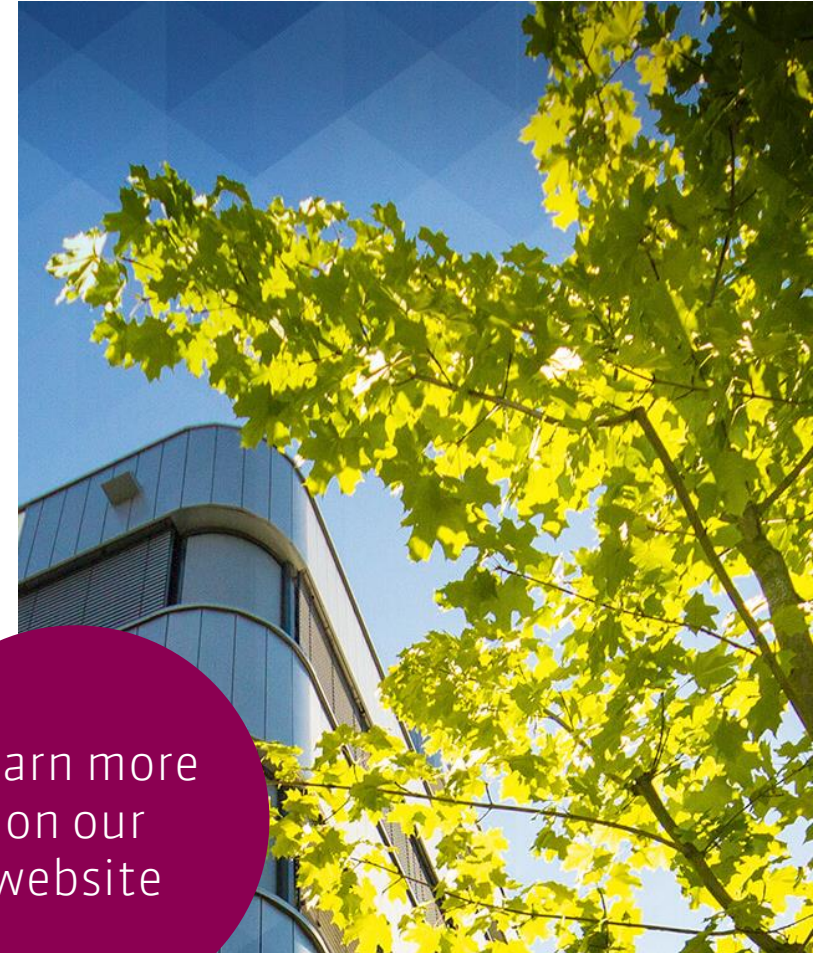
- CE-Pass
- CIRPASS
- DIBICHAIN
- DigiTain
- IDcycLIB
- **ReDiBlock**

Resource Efficiency

- MaFImA

Life Cycle Assessment & Circular Economy

- ACTION
- CARBO BRAKE
- COOLBat
- DigiTain
- DfC-Industry
- iCAREPLAST
- IDcycLIB
- KOLIBRI
- LCT
- LiKE



Learn more
on our
website



Resource conservation through distributed ledger and blockchain technology for industrial production and circular economy

Program	Funded by the Ministry of Environment Baden-Wuerttemberg
Project Partners	Think Tank „Industrial Resource Strategies“ and Karlsruher Institut für Technologie (KIT), Institute for Industrial Ecology (INEC) Pforzheim
Industry Partners	C.Hafner GmbH + Co. KG, egf - Eduard G. Fidel GmbH, Helaba Landesbank Hessen-Thüringen
Duration	Start 10/2020, 24 months + 6 months
Goal	Functional prototype of a digital product passport for concrete use cases based on existing methods and software solutions.



Quelle: Referenz-Nr.: 20150701ST072956, Generaldirektion Kommunikation Europäisches Parlament -



Baden-Württemberg

MINISTERIUM FÜR UMWELT, KLIMA UND ENERGIEWIRTSCHAFT



THINKTANK
INDUSTRIELLE
RESSOURCEN-
STRATEGIEN



INEC
INSTITUTE FOR
INDUSTRIAL ECOLOGY



KIT
Karlsruher Institut für Technologie



CHAFNER
Edelmetall · Technologie



EGF
eduard G. fidel



Helaba
Landesbank
Hessen-Thüringen



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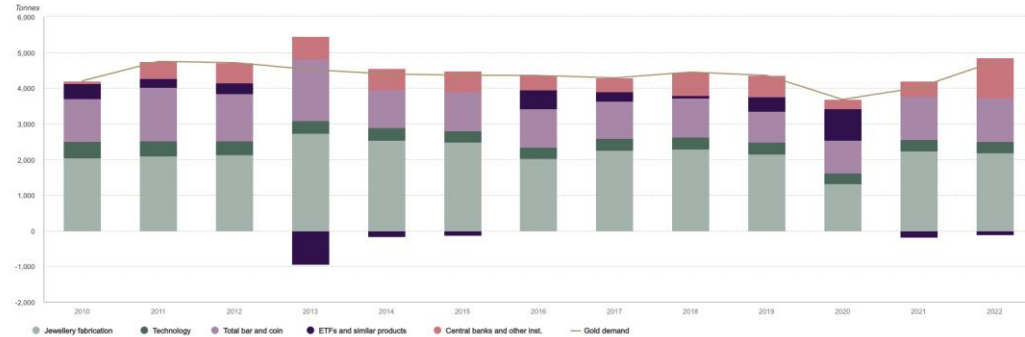
2 | Recycled Gold Use Case

Recycled Gold Use Case

Why gold?

GOLDHUB

2022 gold demand almost matched the 2011 record



Data to 31 December 2022.
Source: Metals Focus, World Gold Council

Global gold demand

- Increases again after 2020
- Stabilizes for technology purposes (dark green bar)
- Gold as an example for other (precious) metals

High potential to reduce CO₂ emissions

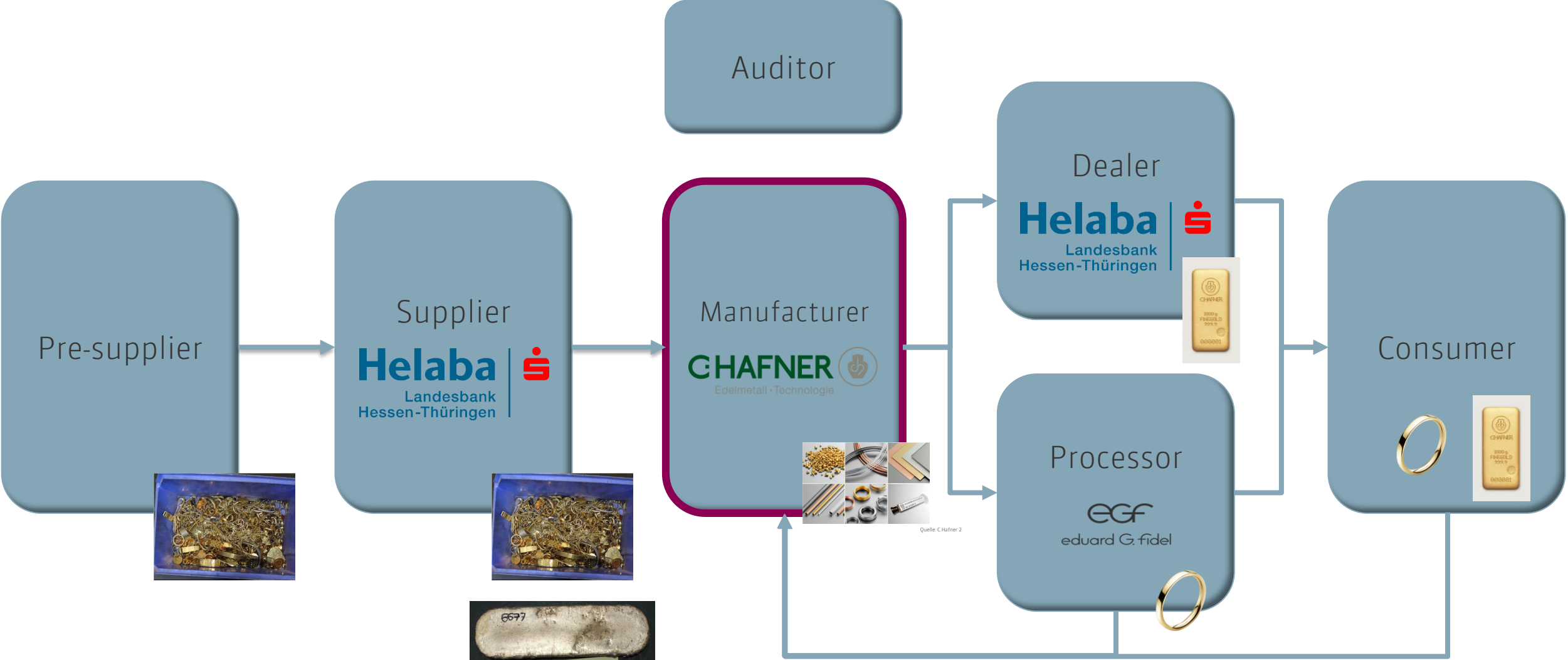
- Up to 300x lower carbon footprint of gold produced from old scrap:
 - Primary gold: **10,988 kg CO₂/kg**
 - Old Scrap C. Hafner: **36 kg CO₂/kg**

Indicator	C. Hafner	WEEE (ecoinvent)	Mining (ecoinvent)	Unit
Cumulative Energy Demand (total)	590	11616	476990	MJ-Eq
Climate change	36	1496	10988	kg CO ₂ -Eq
Value per kg gold granules				

Graph from: <https://www.gold.org/goldhub/research/gold-demand-trends/gold-demand-trends-full-year-2022>

Table from: https://www.c-hafner.de/fileadmin/user_upload/pdf/Life_Cycle_Assessment_and_Carbon_Footprint_of_precious_metal_recycling_by_C.HANFER_-_Summary_INEC_treeze_en.pdf

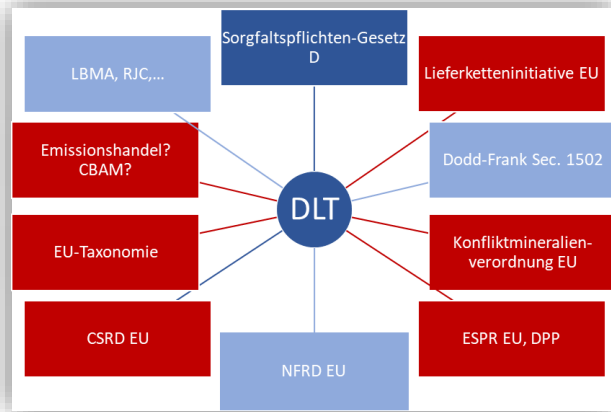
Identified actors in the supply network



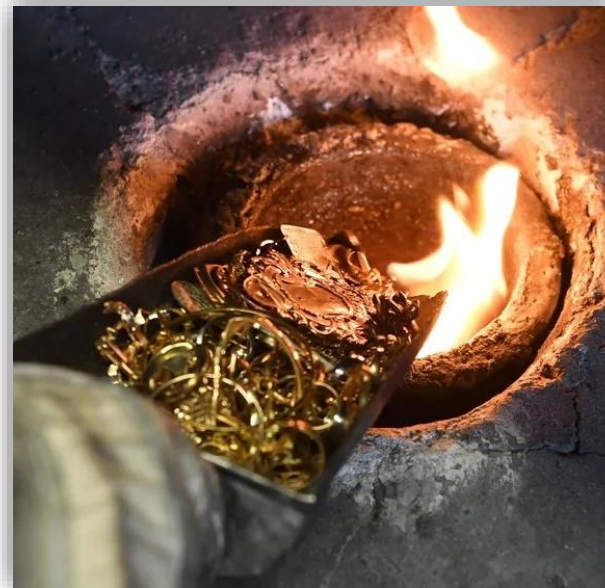
Motivation

Regulation frameworks and business cases

1. Conformity with regulatory framework

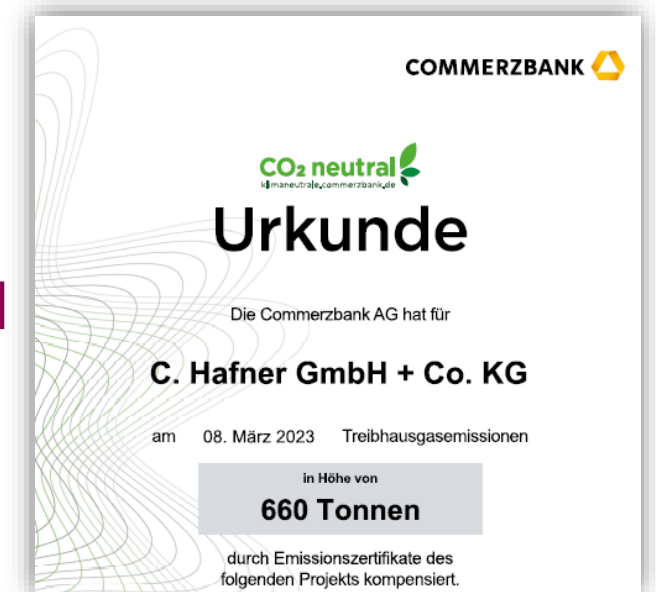


2. Recycling evidence



(Quelle: C.Hafner)

3. Carbon footprinting and climate neutrality



(Quelle: C.Hafner)



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3 | Methods

Methods



1. Supply chain system and process analysis
2. Requirements analysis
3. Persona definition
4. Business case development
5. Analysis and evaluation of different blockchain technologies
6. Concept creation for a blockchain/Distributed Ledger Technology (DLT)
7. Development of a demonstrator for a DLT-supported Digital Product Passport (DPP)



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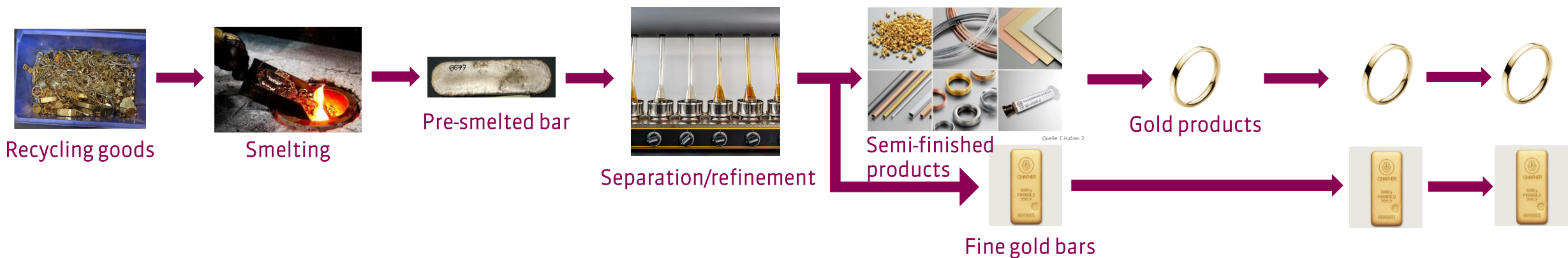
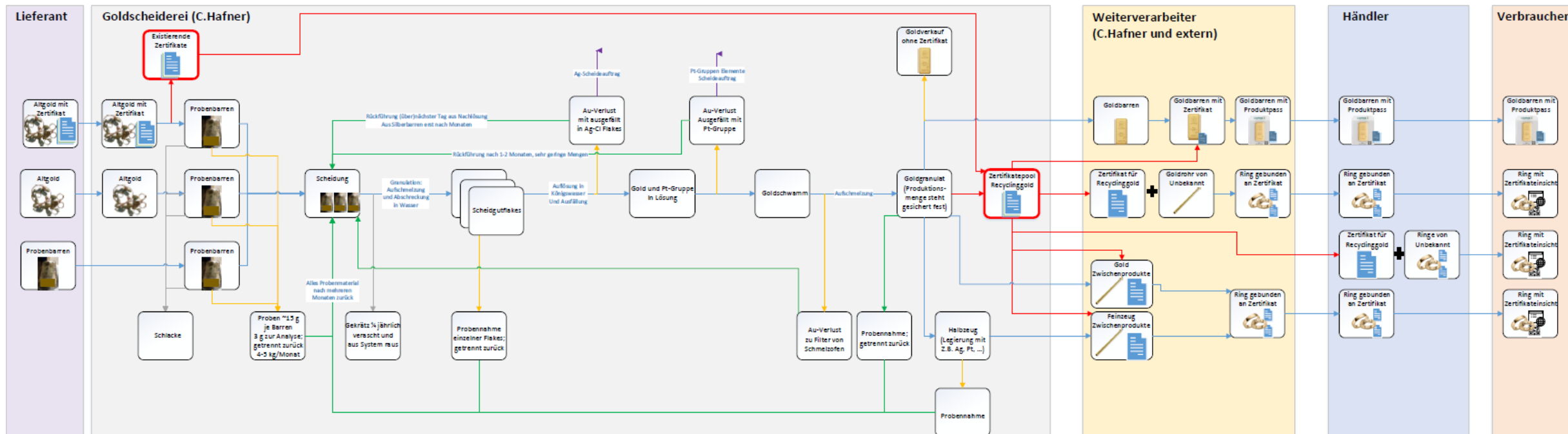
4 | Results

Supply chain system and process analysis

Material flow

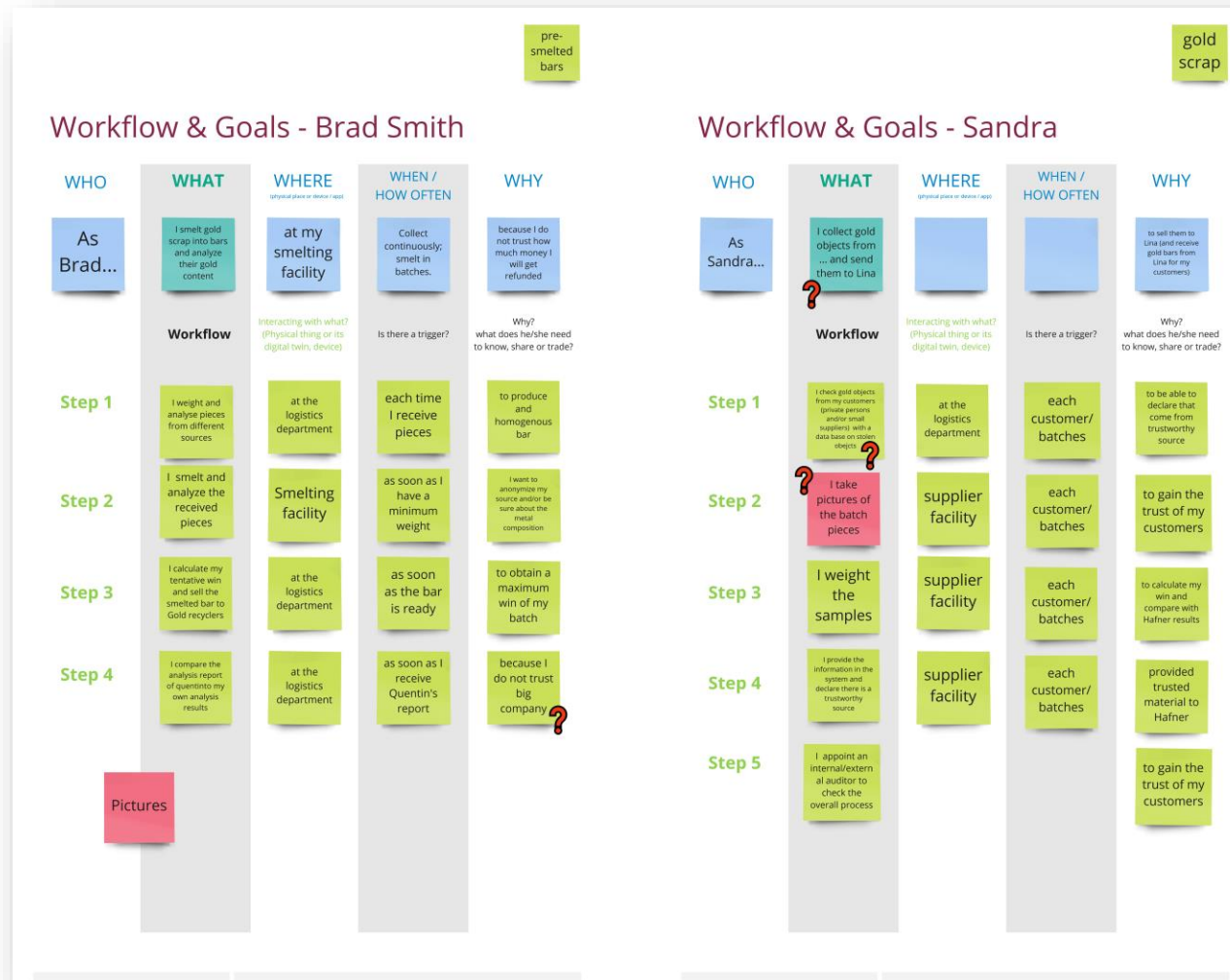


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Requirements analysis

Persona Workshops



Analysis results of the workshops for the **definition of personas** (= fictional representations of software users including their needs and behavior)

The two personas "bar supplier" (Brad Smith, left) and "scrap material supplier" (Sandra, right) are shown here as examples.

Blockchain/DLT design

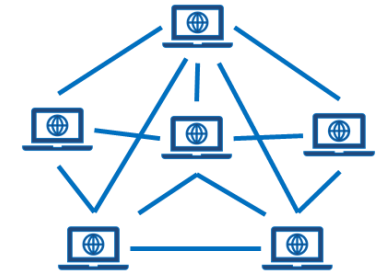
Fundamentals and technical details



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Advantages of Blockchain/distributed ledger technology (DLT)

1. Blockchain as a distributed system to avoid data sovereignty
2. Consensus of several participants is necessary to manifest information
3. Data is "chained" by cryptographic processes and therefore cannot be easily deleted
4. Digital currencies (token) can be applied (e.g. bitcoin)



Technical details of the system's architecture:

- Ethereum (private network, consensus mechanism: Proof of Authority)
- Meta data is stored on the blockchain, product data is stored off-chain
- Tokens represent recycled gold (users can receive and send tokens)



ethereum

Demonstrator: Inventory Dashboard

DLT-supported Digital Product Passport (DPP)



Inventory Dashboard

Pending Transactions [See All](#)

- 0 Inboxes
- 0 Outboxes

My Passports Updated 12.15.2022 15:32pm

- 10 Owned
- 15 Created
- 6 Sent
- 0 Received

Passports [+ Add New](#)

ID	Name	Creator	Owner	Updated ↓
ad5b2...4cf15	Feingoldbarren	Me	Me	01.12.2022, 02:33
21804...f25ba	Scheidgut	Me	Me	01.12.2022, 02:22
b9ca4...f4231	Test Recyclingmaterial	Me	Me	01.12.2022, 10:18
104ea...9e959	Feingold NONCOC	Me	Me	29.11.2022, 03:34
25905...89f69	Altgold Schmuck	Me	Me	25.11.2022, 10:57
a9a5f...affcb	test 2	Me	Me	11.11.2022, 09:42
f78ad...18406	Feingoldbarren 10g	Me	Me	11.11.2022, 09:27
ce53f...eca90	Recyclingbarren	Me	Me	11.11.2022, 09:24

Demonstrator: Passport Detailed View

DPP modules and attributes



cd3eb195-d14b-4b79-8e6d-642b76f116eb

Feingoldbarren

← Back to Inventory

	Producer Name C. Hafner	Material Number 87659	Transaction Hash Id Not specified	Creator iPoint Demo admin@ipoint.io
	Serial Number 0077897987987	Batch Number Not specified	Type Element	Owner iPoint Demo
				Available Weight 10/10 g

Passport Timeline

CREATED 09.01.2023 UPDATED 16.01.2023

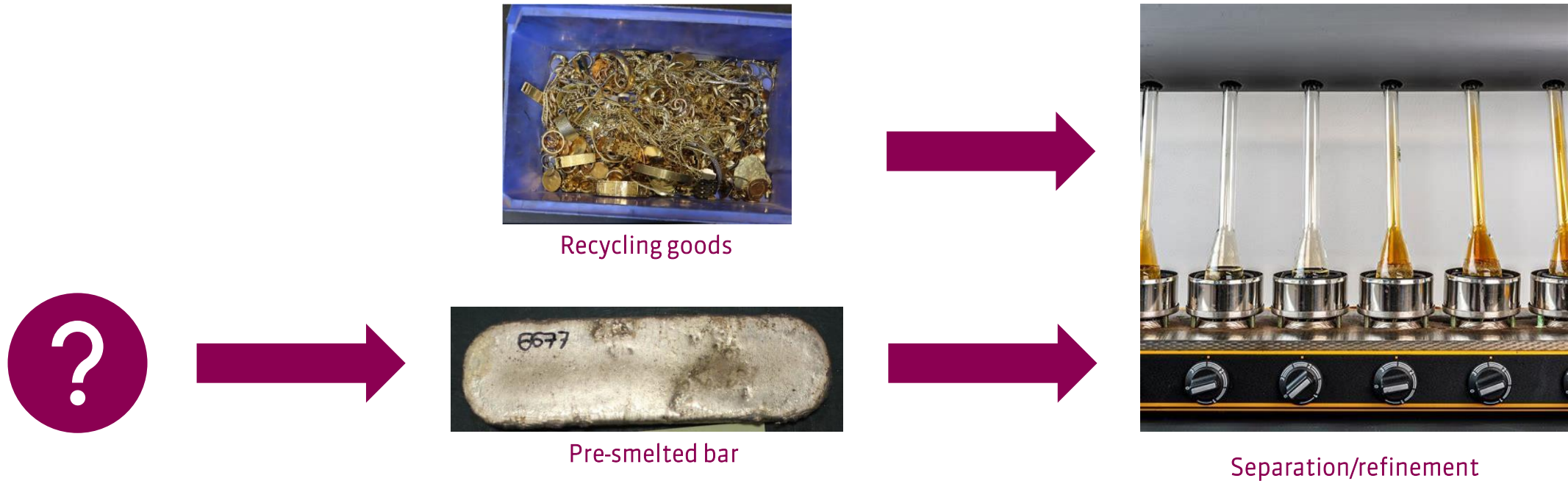
Key Metrics

- Footprint: Not specified
- Recycled Content: 100 %
- Documents: See All (RJC certificate)

Composition + Add New

Identified Pain Points

Source of gold in pre-smelted bars



=> Blockchain-based DPP to increase transparency

Demonstrator

Evidence of source can be attached

Key Metrics

Documents
See All

PDS

Schüttgutnachweis

Showing 1 docs out of 1

Recycled Content
100 %

Recycled

CO₂

Recycling Barren – Inhalt



Nummer	12345
Scheidgut-Charge	LH5576-33
Objekttypen	Ketten, Ringe, Armreif, Münzen, Uhrenarmband
Anzahl der eingeschmolzenen Objekte	223
Gewicht (Summe der Objekte)	2726,5 g
Gewogen von:	Max Mustermann
EAK:	120104
Besonderheiten	Keine
Geschmolzen am	25.07.2022
Geschmolzen von	Max Mustermann

Abbildung Scheidgut:

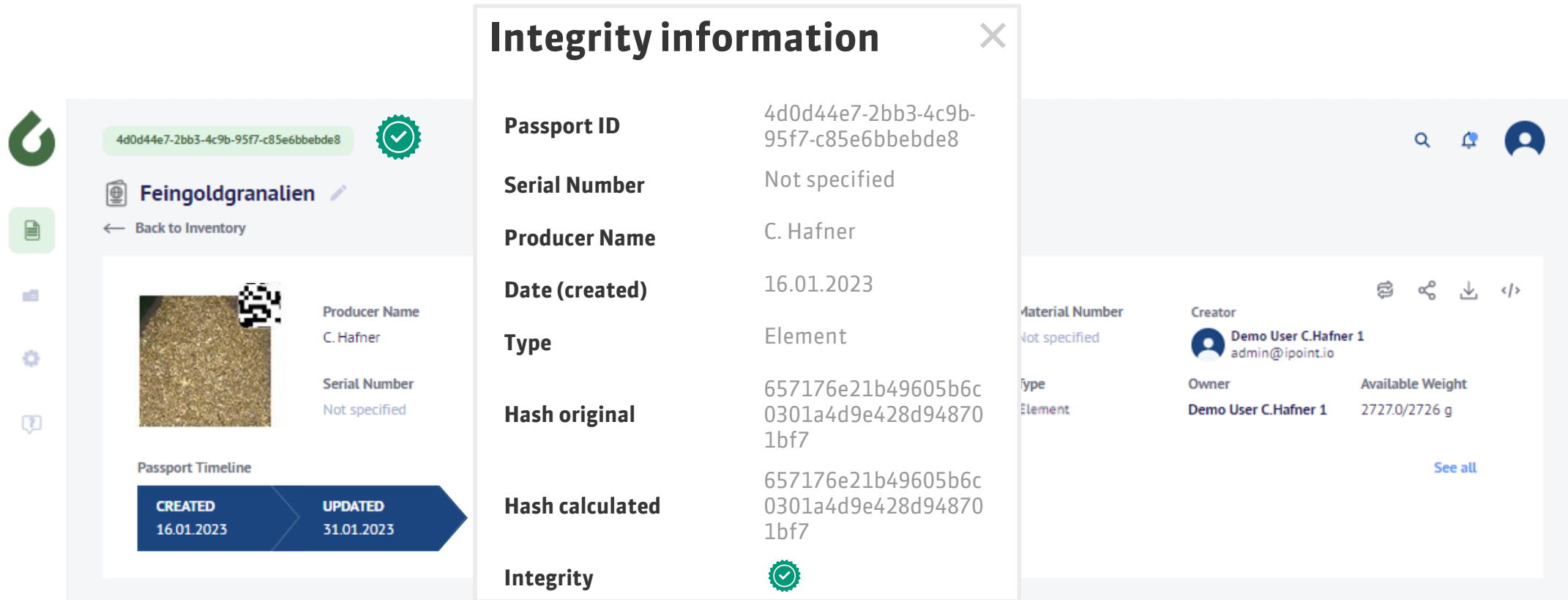


Max Mustermann


Unterschrift Mitarbeiter Leihhaus

Demonstrator: Data Integrity

Data manipulation is prevented via hash functions



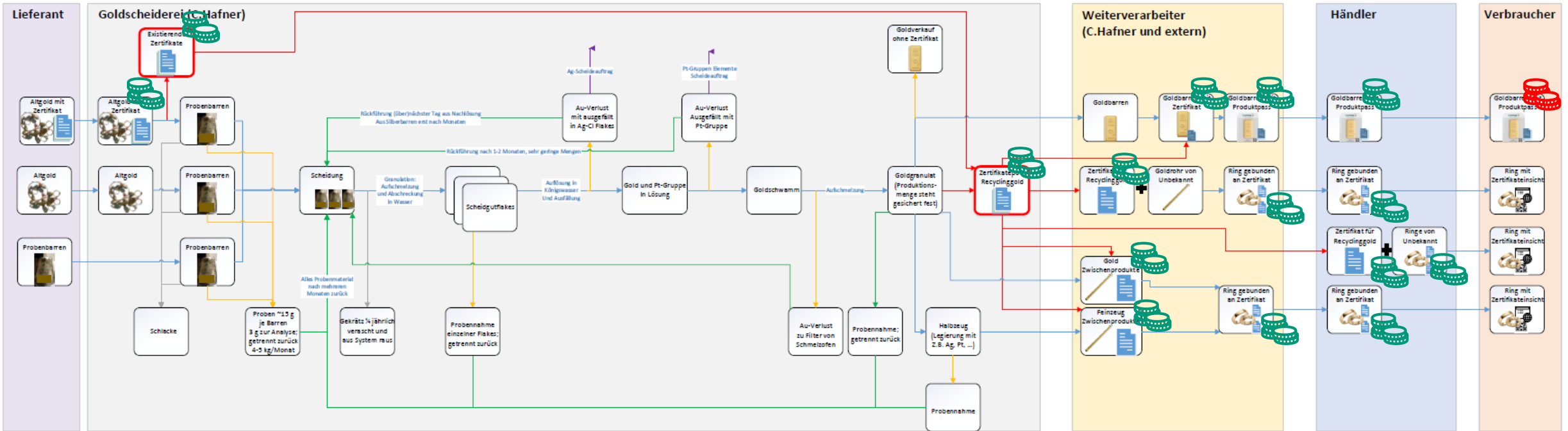
The screenshot displays the iPoint system interface for a product named 'Feingoldgranalien'. The product ID is 4d0d44e7-2bb3-4c9b-95f7-c85e6bbebde8. The product details include a photo of the material, a QR code, and a 'Passport Timeline' showing it was created on 16.01.2023 and updated on 31.01.2023. An 'Integrity information' modal is open, showing the following data:

Field	Value
Passport ID	4d0d44e7-2bb3-4c9b-95f7-c85e6bbebde8
Serial Number	Not specified
Producer Name	C. Hafner
Date (created)	16.01.2023
Type	Element
Hash original	657176e21b49605b6c0301a4d9e428d948701bf7
Hash calculated	657176e21b49605b6c0301a4d9e428d948701bf7
Integrity	

The background interface also shows the 'Material Number' as 'Not specified', the 'Creator' as 'Demo User C.Hafner 1' (admin@ipoint.io), and the 'Owner' as 'Demo User C.Hafner 1' with an 'Available Weight' of 2727.0/2726 g. A 'See all' link is visible at the bottom right of the product details section.

Demonstrator

Recycled Gold Token (RGT)



 Token representing recycled gold, RGT (verify amount and transactions of recycled gold)

Demonstrator: proof of RGT transfers

RGT & Blockchain



4d0d44e7-2bb3-4c9b-95f7-c85e6bbebde8

Feingoldgranalien

Back to Inventory

Transaction Hash Id
0x1afbda20adb453bd5d0c7e6e342a516f658de56b9bca3d3936a2ddc84b239abb

Material Number
Not specified

Creator
Demo User C.Hafner 1
admin@ipoint.io

Serial Number
Not specified

Batch Number
0703111-01

Type
Element

Owner
Demo User C.Hafner 1

Available Weight
2727.0/2726 g

Passport Timeline

CREATED 16.01.2023

UPDATED 31.01.2023

Etherscan

Transaction Details

Overview Internal Txns Logs (3) State

[This is a Goerli Testnet transaction only]

Transaction Hash: 0x1afbda20adb453bd5d0c7e6e342a516f658de56b9bca3d3936a2ddc84b239abb

Status: Success

Block: 8404227 446211 Block Confirmations

Timestamp: 77 days 20 hrs ago (Jan-30-2023 04:19:24 PM +UTC)

From: 0xa443Bfd04676B48049223D2a2F8A005D5fbC508d

Interacted With (To): 0xa418B489061FF62174104EaDea1782AD778297a0

ERC-20 Tokens Transferred: From 0xa418B4...778297a0 To 0xa443BF...5fbC508d For 27,260 RecycledGold... (RGT...)

1. Smart contract executed by gold refinery to receive RGTs representing 2726g recycled gold
2. Transaction Hash IDs from Blockchain for RGT creation or transfer is visible in DPP
3. DPP ID visible on Blockchain



iPoint

5 | Summary

Summary

& Aspects to be clarified

The Blockchain-based DPP system ensures:

- ✓ Evidence of compliance, recycling and carbon footprints
- ✓ Exchanging trusted product data in supply chains through data integrity
- ✓ Certification of the origin of recycled gold verified by recycling token
- ✓ Data sovereignty through off-chain (or off-ledger) storage model. Only metadata is stored on the DLT.
- ✓ Transfer to other (precious) metal use cases and sectors

Aspects to be clarified

- Regulation frameworks: dynamic field, implementation requires clarification (e.g. Conflict Minerals Regulation, Digital Product Passport (ESPR), EU Supply Chain Regulation)
- Business models: value of information for recycling gold and reduced carbon footprints remains vague

Thank you!



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Baden-Württemberg

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