School of Industrial and Information Engineering
Master of Science in Management Engineering

POLITECNICO
MILANO 1863

How Digital Technologies drive the creation of an Innovative KPIs Measurement System in Retail

Supervisor: Prof. Alessandro Perego

Tutors: Ing. Valentina Pontiggia, Dott. Elisabetta Puglielli

Master Thesis of:

Filippo Magnani 883444

Paolo Menzione 900172

Academic Year 2018/2019

Table of Contents

List of Figures

ABSTRACT

Digital Technologies have changed the way companies collect, analyze and interpret data creating new business opportunities related to the customer experience delivery process. The first phase of this process is the creation of a performance measurement system able to provide companies with valuable insights. Retail industry is facing these challenges as well.

Starting from a deep analysis of Digital Technologies and KPIs in Retail, from 40 scientific and 15 non-scientific papers, a gap has been identified: a lack of solutions which allow the monitoring of innovative KPIs during the in-store shopping process. The objective of this thesis is understanding how Digital Technologies are transforming the store, also providing retailers opportunities for monitoring Innovative KPIs related to in-store shopping process.

On the basis of it, an additional theoretical analysis on the KPIs theme has been developed, with the aim studying the more traditional and already monitored KPIs. In parallel, a study on the available innovative technologies in the Accenture Customer Innovation Network has been done, with the objective of studying the current Digital Innovation which are gaining momentum in Retail Industry, and in particular in the Grocery environment. The definition of 16 Innovative KPIs followed these research phases; these KPIs have been analyzed as well.

These research phases preceded the real solution development, in which three steps has been followed: firstly, the collection and manipulation of raw data coming from the tools chosen; secondly, the creation of a joint database and of the KPIs' measurement system on the SAP Cloud Platform; thirdly, the integration of the measurement system with SAP Sales Cloud, a tool used for the Retail execution. This integration closed the end-to-end development phase.

The last part of the work focused on the identification of the main qualitative benefits and expenses related to a potential solution implementation: the possibility of collecting stores, products and customers insights and giving sales representative the possibility of access this information during their daily work are the most valuable beneficial aspects of the solution.

1. Executive Summary

1.1 Introduction

Nowadays, data are one of the greatest value sources for every company. Data collection, analysis and interpretation have become crucial and companies are committing efforts in order to extract the maximum value from them.

Customers are continuing expecting for an experience which results hyper-customized, frictionless, omnichannel and relevant and, in order to provide such an experience, companies need data.

Traditional data are no more sufficient; therefore, companies leverage on Digital Technologies to collect information from “non-common” sources; information obtained provide valuable insights which trigger specific actions, both proactive and reactive.

Retail industry is facing these changings as well: “common” data, such as transactional ones, are important but not enough for the delivering of an experience valuable for customers. Collecting in-store and related to products data is the first step of the experience delivering; analyzing how the latter are performing allows the identification of “non-traditional” insights which, as already said, trigger action devoted to the improvement of the experience.

The only way to do this is to exploit Digital Technologies to collect new type of data from processes considered before as a “black-box”.

Retailers must strongly act on these directions because the only way to engage customers and survive to the multiple digital services which propose themselves as substitutes, is delivering a differential and valuable experience, which is only made possible thanks to the collection and exploitation of data.

1.2 The objectives

The objective of this thesis is understanding how Digital Technologies are transforming the store, also providing retailers opportunities for monitoring Innovative KPIs related to in-store shopping process. Different topics have been covered.

First, the necessity of evaluating stores and products performances during the in-store purchase process: today retailers and CPG companies have few information about what happens between the check-in and check-out phases. Gathering in-store data, where the real conversion takes place, about how a product or a specific store area are performing, allows companies to have a meaningful and complete view over the entire shopping process. Second, the necessity of collecting customers' data inside the store: understanding how customer behave, their habits and patterns is fundamental for the creation of efficient and effective campaigns in terms both of targeting and content creation. Third, the necessity of having an end-to-end solution which covers the entire in-store purchase process and connects all the actors involved, from who inside the company collects and analyses data to who can exploit them (e.g. sales representative during Retail execution activities). Fourth, currently there are no end-to-end solution, collecting data from customer and evaluating the store and the product performances during the in-store shopping process. An easy-implementable solution, integrable with every company ERP would be a cutting-edge in the Retail industry.

In order to cover these topics, the following research questions have been defined:

1. How do both the scientific literature and the non-scientific one debate on the thematic of Digital Innovations related to Performance Measurement in Retail Industry?
2. Which are the current KPIs retailers and CPG companies monitor during the end-to-end shopping process?
3. How Digital Technologies enhance the store evolution in Italy?
4. Which are the today-available Digital Technologies allowing the collection of data on customers inside the store?
5. How Digital Technologies create new opportunities for the definition of Innovative KPIs?

6. Is there the possibility to design an end-to-end and ready-to-use solutions exploiting opportunities stemming from the adoption of Digital Technologies?

1.3 The framework

This work is organized in 7 different phases:

1. The literature reviews
2. The traditional KPIs analysis
3. Store evolution overview
4. The technology analysis
5. The Innovative KPIs definition
6. The solution development
7. The identification of the solution benefits and costs

Here below the framework of the thesis work.

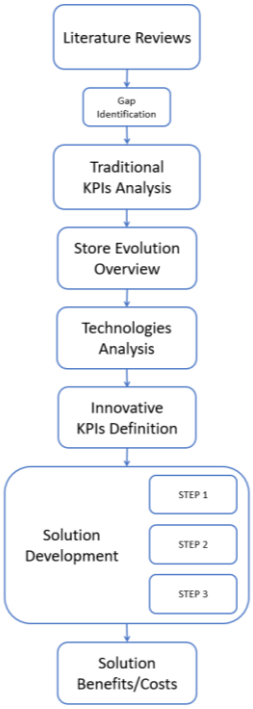


Figure 1. The Research Framework

The literature review

The literature reviews consisted of a deep analysis of 55 papers, and, in particular, 40 scientific and 15 non-scientific ones. This analysis refers to three main themes: Retail, Digital Innovation and KPIs.

Each paper collected has been classified through the definition of a framework, organized in the following way:

- **General information**: this part refers to the title of the paper, the year of publication, the author who worked at it and the source;
- **Focus**: it refers to which topic(s) is(are) covered by the paper among the three investigated;
- **Methodology**: it refers to how the paper has been redacted. The macro categories are Quantitative approaches and Qualitative ones;
- **KPIs**: in KPIs-discussing papers, this dimension refers to the objective of KPIs (i.e. monitoring efficiency or effectiveness performance), the phase the KPI refers to (shopping-process before checkout, checkout), and the focus of the KPI among Product, Customer, Transaction, Area;
- **Innovation purpose**: it refers to which performance improvement the innovation discussed in the paper enhances, and which aspect of the customer experience impacts on;
- **Digital Innovation**: this part aims at classifying which Digital Innovations are exposed in the paper;
- **Industry and Market analyzed**: these dimensions provide information on the generic or specific nature of the industry and the market discussed by the paper.

The main objectives are the clear understanding of what has been already studied or developed (experiments, models, frameworks, etc.) and the discovery of a literature gap, that is a specific theme or aspect the literatures (scientific and non-scientific) have not already deepened.

The traditional KPIs analysis

The subsequent phase has been the one of understanding which are the current KPIs retailers and CPG companies monitor. To deepen this topic several researches have been made, collecting information from both KPIs dedicated repositories such as "KPI library" (a crowd-sourced repository which collects KPI definitions, templates, examples and participated in KPIs benchmark surveys) and academic material provided by Osservatorio Innovazione Digitale nel Retail of Politecnico di Milano. A classification framework has been developed according to different dimensions:

- **Coverage Categories** among Product, Customer, Transactional and Store Area (clearly some KPIs cover more than one dimension)
- **Usefulness** for business players such as retailers and CPG companies (which is, usually, the player who monitor that KPI).

36 KPIs labelled as "traditional" have been selected and classified.

Store evolution overview

In the third part, a deepening of how Digital Innovations are transforming the store has been carried out. In collaboration with Osservatorio Innovazione Digitale nel Retail of Politecnico di Milano, a study on the 80 among 300 top retailers by turnover in Italy has been conducted, in order to get an overview on which are the main Digital Innovations implemented by them and how they impact on back-end processes, front-end ones and ways of re-thinking the meaning of the physical store. In addition, 100 projects aiming at designing the store of the future have been analyzed.

Technologies analysis

The fourth phase consisted in deepening which are the current rising Digital Technologies that are about to determine the evolution of the store. As a 6 months full-time internship in Accenture Technology was being experienced, it has been spotted the possibility of deepening the knowledge of the Digital Technologies which are getting momentum working in Accenture Customer Innovation Network (ACIN), which is an environment highly closer to customers for co-developing new innovative scenarios and where real-cases are studied. Accenture gave the possibility of moving there stably. This

innovation center presented inside different thematic rooms, each one with different characteristics: the Smart Grocery, the Smart Boutique, the Digital Bar and the Smart Home. Since the focus of this research is understanding how Digital Technologies impact on the store and its processes, and, given the fact that the Smart Grocery is the richest thematic room in ACIN from the technology availability point of view, the focus has been directed on it.

Figure 2. The Smart Grocery

Innovative KPIs Definition

The knowledge acquired from the traditional KPIs studies integrated with the one gained from ACIN and in particular from the Smart Grocery, laid the groundwork for the fifth part of this thesis work: 16 innovative KPIs have been defined and classified according to the same framework as the traditional ones (categories coverage among customer, product, transactional, area and usefulness for business players such as retailers and CPG companies).

After these analyses, the focus moved onto how both Digital Technologies and Innovative KPIs enabled by the former, transform the physical store concept: on one side, technologies improve the final customer experience, on the other new KPIs enrich the knowledge retailers have about customer and their behavior during the in-store shopping process thanks to the possibility of exploiting valuable insights stemming from interpretation of them.

Solution Development

At this point, it has been possible to test the exploitability of the opportunities coming from either the Digital Technologies and the new KPIs; this thanks to the development of and end-to-end solution based on the integration between an Innovative KPIs Measurement System and an IT infrastructure in a Retail likely scenario, that is the Smart Grocery one.

The IT infrastructure chosen to develop the solution has been SAP (described in *7.3* section), since it is one of the most important company IT solutions provider and, in addition, since some experiences have been gained on it during the first part of the internship and a kind of confidence with the tool has been obtained. Among the technologies available in ACIN, two of them have been chosen: a laser sensor (Hitachi ToF) which registers interactions between shelf and customers (e.g. picking up a product) and a software which through a cam detects ethnographic data (e.g. gender, age,…) and mood and attention ones (described in *7.4* section).

The design of the end-to-end solution consisted in three main steps. The first one concerned the study of the two technologies, the way data are registered and how to make possible the integration in a unique database. Secondly, the focus moved onto the uploading of all the data in a joint database on SAP CLOUD PLATFORM and, consequently, how to work with the database to pass from data to information (i.e. KPIs). Finally, the last step consisted in integration of SAP CLOUD PLATFORM with SAP Sales Cloud, a module of SAP used by salesforce during their daily activities.

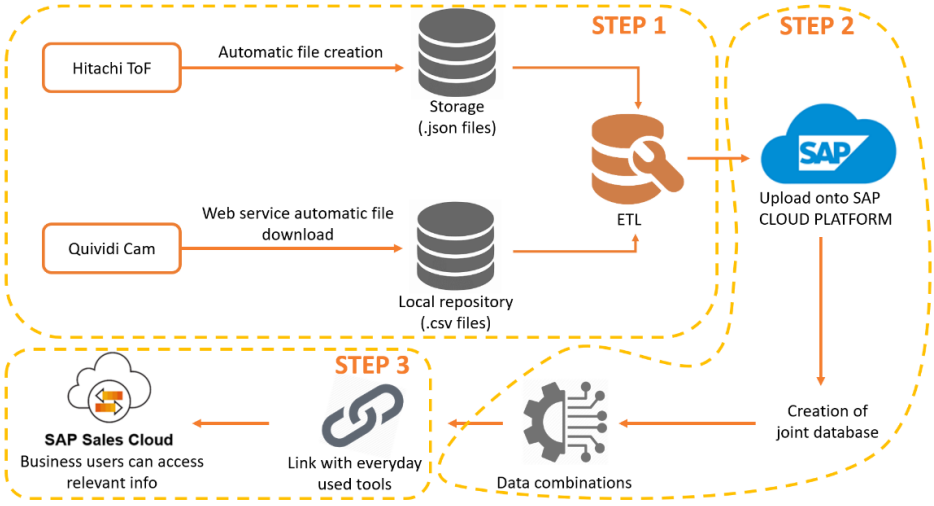


Figure 3. The Solution Steps

Once assessed the feasibility of the solution designed, the focus shift onto evaluating the benefits and the costs related to the possible adoption of such an integration between data sources (i.e. Digital Technologies) and IT Systems.

1.4 The results

In this sections, main findings of this thesis work will be presented. They are exposed on the basis of how this thesis answers the research questions proposed in the objectives.

1. **How do both the scientific literature and the non-scientific one debate on the thematic of Digital Innovations related to Performance Measurement in Retail Industry?**

Starting from the scientific literature review, the today available academic material has been examined to understand what studies have been carried out until now concerning Digital Innovations and KPIs in Retail Industry. The following image reports the number of papers found for area of investigation (Retail, Digital Innovation, KPI) and their intersections.

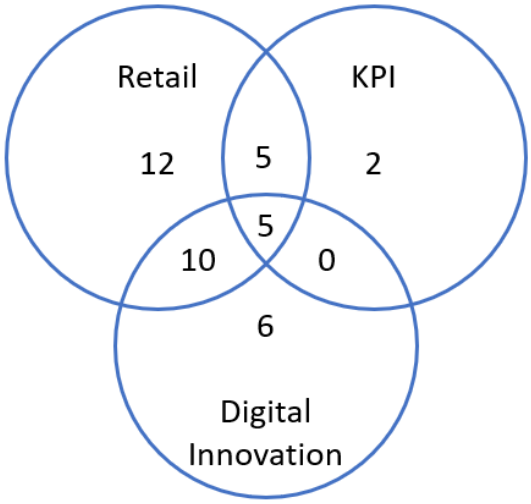


Figure 4. Literature analysis results. Numbers represents how many papers cover one or more areas of investigation

Referring to the image above, the thematic of Digital Innovation in Retail Industry is discussed (15 papers out of 40). Among these papers, both front-end aspects (towards

the enrichment of customer experience) and back-end ones (towards the improvement of processes efficiency) have been analyzed.

Considering the 10 papers related to KPIs intersection with other areas of investigation, only measures computed starting from transactional data (e.g. sales) have been found. In particular:

- 5 papers cover the intersection between Retail and KPIs areas. These papers aim at getting information regarding if and how sales are correlated to specific variables, non-related to Digital Technologies (e.g. store layout, volume music, scent diffusion in the store), influencing how customers do behave in the store
- 5 papers cover the three areas of investigation; these papers study how Digital Innovations inside the store have an impact on transactional KPIs. For example, how in-store digital displays, changing content according to the profile of customer exposed, have an impact on sales

The results stemming from the scientific literature review highlight a particular academical interest in evaluating how transactional KPIs change according to the introduction of Digital Innovation in store, without evaluating other aspects of the shopping process.

Moving to the non-scientific literature review, a series of upcoming trends that could impact the in-store Retail scenarios have been underlined and how different companies are moving to face and embrace them has been analyzed. Most of players are trying to understand how better invest in Innovative Technologies to catch new opportunities.

In particular, the main Innovations players invest or want to in Retail are the following:

- AI
- Digital Kiosk
- VR/AR
- Smart Windows
- In-store mobile interactions technologies
- Self-service scanning and checkout technologies
- CRM Systems

Digital Innovations are an element that could represent new data-sources. The non-scientific literature focuses mainly on the study of them, without a clear understanding of how to exploit data gathered.

Once both the scientific and the non-scientific literature reviews have been concluded, it has been possible to spot a gap. In particular, no focus has been evidenced on how Digital Innovations could provide players opportunities for monitoring in-store shopping process aspects through new measures not relying on transactional-data.

This thesis work aims at deepening this aspect.

2. **Which are the current KPIs retailers and CPG companies monitor during the end-to-end shopping process?**

To get an overview of what are the KPIs currently used by retailers and CPG companies in order to assess their performances, 36 KPIs have been collected and labelled as "Traditional". Analyzing them through the framework described in the section *1.3*, it resulted that the majority stem from transactional data (in accordance with the scientific literature results), because they are computed on the basis of data related to sales. Following it is shown the bar chart reporting the numbers of how many KPIs among the 36 collected covers each of the four categories considered (Product, Customer, Transactional, Area).

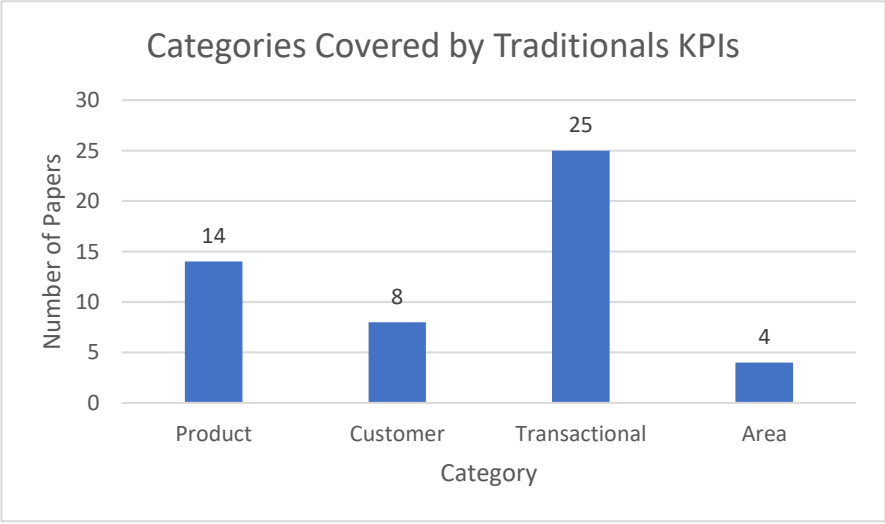


Figure 5. Categories Covered by Traditional KPIs. Numbers refer to how many KPIs cover each category.

As it is possible to notice, transactional one is the category where the most of KPIs has been classified in. The sum of the different columns has a value greater than 36 since some KPIs have been classified in more than one category (e.g. GMROI, *Gross Profit on Average Inventory* categorized in Product and Transactional).

Following, the list of KPIs collected is presented, organized for each category.

KPIs related to Products

KPI	FORMULA or EXPLANATION
Sales	Total revenues
AVG Batch dimension	#Units_Sold/#Purchasesincludingthatitem
Conversion rate	% of visitors taking a desired action
Stock turn	COGS/Avg Inventory
GMROI	Gross Profit/Avg Inventory
Sell Throught	(Number Of Unit Solds/ Beginning Inventory)*100
Inventory to sales ratio (ISR)	Inverse of stock turn
Product shelf-space profitability	It measures the profitability of a product compared to the space occupied on shelf
Coupon conversion %	It measures the effectiveness of a promotion
% of store assortment available also on website	It measures how online and in-store assortment are similar
Product share on shelf	It measures the percentage of space occupied by a product on the totality of shelf
Share of wallet	The expense of a customer related to purchase of a specific product in a product category
Share of voice	How many times the name of the company is mentioned compared to numbers of mentions of the category

Figure 6. KPIs related to Products with Formula or Explanation

KPIs related to Customers

KPI	FORMULA or EXPLANATION
AVG Number of items purchased	Total Number Of Items Purchased/Number Of Purchases
Time spent in the store	Number of minutes the customer spends in the store
Traffic	Number of customers visiting the store during a period of time
Customer retention	((CE-CN)/CS)*100
Frequency of store visits	Number of times a customer visits the store in a defined timeframe
Coupon conversion %	It measures the effectiveness of a promotion
Share of wallet	The expense of a customer related to purchase of a specific product in a product category
Repeat buyers	Ratio of fidelized buyers compared to total number of buyers

Figure 7. KPIs related to Customers with Formula or Explanation

KPIs of Transactional type

KPI	FORMULA or EXPLANATION
Sales per employee	Net Sales/Number Of Employees
Sales	Total revenues
AVG Batch dimension	#Units_Sold/#Purchasesincludingthatitem
AVG Number of items purchased	Total Number Of Items Purchased/Number Of Purchases
Sales per square foot	Net Sales /Amount of Sales Space
Conversion rate	% of visitors taking a desired action
Gross profit	Sales Revenues - COGS
Net profit	All Revenues - All Expenses
AVG transaction value	Total Revenues/#Transactions
Stock turn	COGS/Avg Inventory
GMROI	Gross Profit/Avg Inventory
Sell Throught	(Number Of Unit Solds/ Beginning Inventory)*100
Back order rate	Amount of orders that cannot be fulfilled at the moment the customer places an order, divided by the total number of orders
Rate of return	Number of Order Returned/Total Order
Order status	Overiview of the status of current orders
Perfect order status	It measures the % of good managed orders
Inventory to sales ratio (ISR)	Inverse of stock turn
AVG shelf space cost	It measures how a unit of shelf space costs
AVG shelf space profit	It measures the profitability of a shelf space unit
Coupon conversion %	It measures the effectiveness of a promotion
Sales per selling hour	It measures the sales level per hour
% of revenues per brand	% of revenues generated by products of the same brand
Product category on total sales	% of sales of a category on total revenues
Shopping cart abandoned rate	% of customers who do not end shopping
Repeat buyers	Ratio of fidelized buyers compared to total number of buyers

Figure 8. KPIs computed on the basis of transactional data with Formula or Explanation

KPIs related to Area

KPI	FORMULA or EXPLANATION
Sales per square foot	Net Sales/Amount of Sales Space
Traffic	Number of customers visiting the store during a period of time
AVG number of employees per store	It measures the avg number of people working in a store
Product share on shelf	It measures the percentage of space occupied by a product on the totality of shelf

Figure 9. KPIs related to Area with Formula or Explanation

As it is possible to notice, most of information is related to transactional aspects. This underlines that what happens inside the store during the shopping process is today mainly unknown.

3. How Digital Technologies enhance the store evolution in Italy?

To get an understanding of how Italian Retail Context is changing thanks to the adoption of Digital Technologies, in collaboration Osservatorio Innovazione Digitale nel Retail of

Politecnico di Milano, a survey among 80 top Italian retailers and 300 among SME Italian retailers has been conducted.

Given the opportunities by the adoption Digital Technologies, the shop transformed itself and its span of action: firstly, building a relation with customer thanks to data collected is now possible; secondly, the store is integrated with other touchpoints in order to create a unique view of the customer. So, Digital Technologies became the enabler of the evolution of the physical store, from a transactional place, where focus is centered on product, to a more complex one, where the focus follows a relational logic and, consequently, customer-oriented.

The main barriers players are facing today in embracing Digital Technologies are 1) a lack of a clear strategic view of innovation, 2) the presence of a top management not embracing changing opportunities, 3) difficulties in developing or acquiring digital competences and business roles and, in the end, 4) a missing link between theorical studies and a practical implementation.

4. **Which are the today-available Digital Technologies allowing the collection of data on customers inside the store?**

To better answer this research question, the study has been conducted during a 6 months full-time internship in ACIN – Accenture Customer Innovation Network, since it is one of the most important innovation center in Italy. It hosts different experiential rooms (as Smart Grocery, Digital Bar, Smart Home, Smart Boutique); in each thematic room the most promising Digital Technologies are installed, in order to be studied and identify business opportunities.

Since the focus of this research understanding how Digital Technologies impact on the store and its processes, the most suitable room resulted to be the Smart Grocery.

During this research phase, in addition to the theorical study of the technologies, it has been possible to test them in order to deepen the understanding of how they function.

Two types of Digital Technologies have been identified:

1) **Experience enhancing technologies**: they refer to all the ones that influence customer experience changing the way clients do shopping, introducing in the process new possibility of interaction. Examples of this kind of technologies, installed in the Smart Grocery, are recommendation engines, interactive totem, digital intelligent displays (changing content according to people watching).
2) **Pure customer knowledge improving technologies**: they refer to the ones not impacting directly the way clients do shopping but collecting data that could be turned into knowledge on behavior, preferences and other relevant information to leverage on for insights development. Examples of this kind of technologies are laser sensor monitoring how customers moves inside a certain area, biometric cam-based software, eye-tracking devices. The first two are indeed installed in the Smart Grocery.

5. How Digital Technologies create new opportunities for the definition of Innovative KPIs?

The studies of the traditional KPIs and of the Digital Technologies laid the groundwork for designing new KPIs. 16 KPIs have been defined, labelled as "Innovative" and analyzed according to the same framework used for the Traditional KPIs (presented *1.3* section). In the design phase, the focus has been towards the definition of performance indicators which could monitor aspects different from the transactional one (yet deeply analyzed by Traditional KPIs). In fact, most of the Innovative KPIs covers aspects in common among product, customer and area and just one is still focused on data gathered from transactions.

Following it is shown the bar chart reporting the numbers of how many KPIs among the 16 defined covers each of the four categories considered (Product, Customer, Transactional, Area).

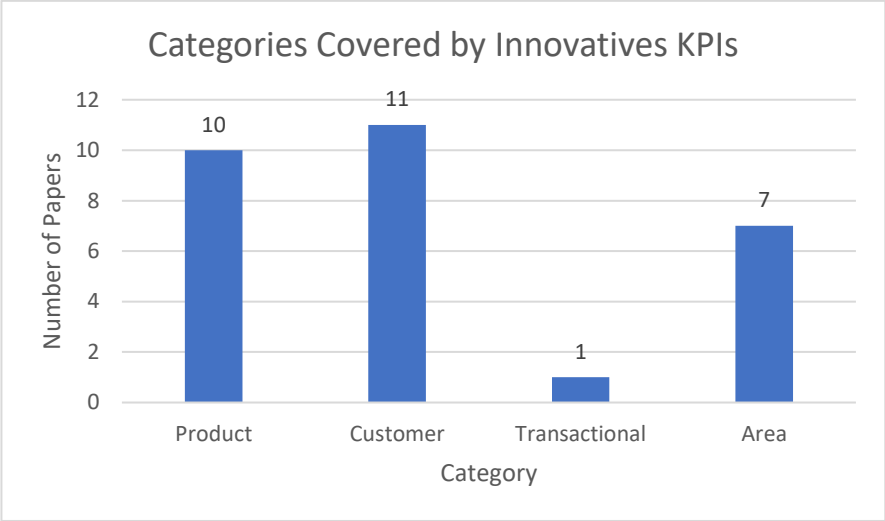


Figure 10. Categories Covered by Innovative KPIs. Numbers refer to how many KPIs cover each category.

The adoption of this KPIs give the opportunity to retailers and CPG companies to acquire knowledge and look at the in-store shopping process no more as a "black box" but as a something measurable and understandable.

The following table reports the 16 Innovative KPIs with associated description.

METRIC	DESCRIPTION
$TimeInFrontOfShelf_{avg}[s/client] = \frac{\sum time\ in\ front\ of\ shelf\ of\ each\ customer}{\#customers\ registered}$	It measures the average time that a client spends near a specified shelf.
$AttentionRate[\%] = \frac{\sum attention\ time\ of\ customers}{\sum time\ of\ exposure} * 100$	This KPI provides information of the total time spent by a client in front of shelf and the time spent in front of shelf paying attention.

$$Interaction\ Rate[\%] = \frac{\#customers\_interacting}{\#watchers} * 100$$	This KPI is defined as the ratio between the number of customers interacting with a product exposed on the shelf and the number of watchers (people paying attention at least a moment to the shelf). It basically can be conceived as a conversion rate showing how a product performs on shelf.
$$AppealingRatio_{productX}[\%] = \frac{\#interactionwithproductX}{\#interactionwithcategory} * 100$$	It is the ratio of the number of interaction of customers with a product over the ones with a category. This information provides something like the ratio of sales of a product over the sales of a whole category but has a focus on the interaction process.
$$TargetCoherence[\%] = \frac{\#interactions\_in\_target}{\#interactions} * 100$$	Considering the total number of interactions with a product, this KPIs is the measure of how much of them are carried out by customers with a profile "in target".
$$InteractionMoodRatio[abs] = \frac{\sum avg\_mood\ interacting\ customers}{\#interacting\ customers}$$	This KPI reflects how customers interacting with a specific product are feeling.
$$WatchersMoodRatio[abs] = \frac{\sum avg\_mood\ watchers}{\#watchers}$$	This KPI reflects how customers paying attention to a specific product are feeling.
$$OpportunityRatio[\%] = \frac{\#watchers}{\#opportunitytosee} * 100$$	This KPI is computed making the count of watchers (people that pass in front of the shelf and pay at least a moment of attention) and the Opportunity to see (people that pass in front of the shelf without paying attention).

$RealTimeMarketingConversionRate[\frac{units}{s}] = \frac{\#pickings}{\sum secondsofcontentdisplaying}$	This KPI is supposed to be monitored as tool when there are advertising activities in the store, to measure the effectiveness of the in-store marketing activities.
$AreaTrafficRatio_{specificarea}[\%] = \frac{\#peopleinanarea}{maximum_{number_{of_{people}}}} * 100$	This KPI provides information regarding the traffic in a specific area of the store.
$RepositiongRate[\%] = \frac{\#re-positionings}{\#interactions} * 100$	This KPI provide information of how many times a product is picked up and it is put back on the shelf by the customers.
$WatchProductTimeRatio[\%] = \frac{Seconds_{watching_{the_{product}}}}{Seconds_{watching_{the_{shelf}}}} * 100$	This KPI is defined as the percentage of time spent watching the entire shelf related to observation of a specific product.
$PlanogramStockCompliancy[\%] = \frac{\#stockoutproducts}{\#productsexposedonshelf} * 100$	This KPI monitors the level of products stock-out on shelves.
$PlanogramPricesCompliancy[\%] = \frac{\#productswithwrongprice}{\#productsexposedonshelf} * 100$	This KPI monitors the price compliancy of products stocked on shelves.
$AVG_{checkout_{time}}[s] = time\ needed\ to\ pay\ and\ exit\ the\ store$	This KPI considers the time needed for a customer to pay and exit from the store.

$TimeBeforeInteraction[\frac{s}{client}] = \frac{time\ spent\ by\ a\ customer\ before\ interacting}{\#interactingcustomers}$	It represents the time needed for a client before doing an interaction with a product exposed at shelf.

Figure 11. Innovative KPIs with Metrics and Description

6. **Is there the possibility to design an end-to-end and ready-to-use solutions exploiting opportunities stemming from the adoption of Digital Technologies?**

What came out from interacting in Accenture with Retail Industry experts confirmed that today there is no evidence of end-to-end solutions aimed at monitoring non-transactional store performances and customer behavior during the in-store shopping process leveraging on Digital Innovation.

It has been given the opportunity to test the possibility of developing the solution in a Retail likely scenario, that is the Smart Grocery. During the last part of the internship in Accenture, the efforts have been focused on designing the end-to-end solution and on the related configuration of SAP modules.

The results have been the effective implementation of the KPIs Measurement System for one store: the Smart Grocery.

Technologies chosen, (Hitachi ToF and Quividi Cam) have been installed and configured. Next, some tests to understand their data output have been done; finally, a shelf with beverage products exposed in Smart Grocery has been mapped. The excel file with planogram information is shown in following image.

	A	B	C	D	E	F	G	H	I	J	K
1	*Planogram*	SHELF	COORDINATE X (cm)		COORDINATE Y (cm)		CATEGORY				
2			lower bound	upper bound	lower bound	upper bound	NAME	LOWER BOUND (X)	UPPER BOUND (X)	LOWER BOUND (Y)	UPPER BOUND (Y)
3	Estathe pesca	1	-57.5	-40	127	>127					
4	Estate limone	1	-40	-22.5	127	>127					
5	Beltè	1	-22.5	-6	127	>127	THE'	-57.5	47	127	>127
6	San Benedetto limone	1	-6	10.5	127	>127					
7	San Benedetto pesca	1	10.5	28	127	>127					
8	San Benedetto verde	1	28	47	127	>127					
9	Aranciata San Pellegrino Blu	2	-57.5	-40	94	127					
10	Aranciata San Pellegrino Verde	2	-40	-22	94	127					
11	Chinotto	2	-22	-13	94	127					
12	Spumador	2	-13	-4.5	94	127					
13	Ginger	2	-4.5	5	94	127					
14	Pepsi	2	5	21	94	127					
15	Coca Cola	2	21	47	94	127	SOFT FIZZY DRINKS	-57.5	47	0	<127
16	Fanta Orange	3	-57.5	-29.5	<93	93					
17	Guizza	3	-29.5	-20.5	<93	93					
18	Lemonsoda	3	-20.5	-12.5	<93	93					
19	Schweppes	3	-12.5	13.5	<93	93					
20	Schweppes Limone	3	13.5	30.5	<93	93					
21	San Benedetto Limone Zero	3	30.5	47	<93	93					

Figure 12. Smart Grocery Beverage Shelf Planogram

The next step has been uploading the data gained from databases to SAP Cloud Platform where a joint view has been created and KPIs extracted.

SAP Sales Cloud have been configurated and integrated in order to give the possibility to the sales people to consult the KPIs and obtain insights during their daily activities.

Example of a scenario (i.e. Perfect Store) exploiting this solution has been presented.

Concluding, a qualitative analysis on benefits and costs related to potential implementation of the solution has been conducted.

Benefits provided by the adoption of this solution are multiple. They can be summarized in the fact that the store could be transformed from being a “black box” where nothing about customer in-store shopping process is known to an environment in which technologies enable the creation of knowledge about both customers and products. Leveraging on this, marketing activities can be more successful acting on the basis of insights gathered. Product development as well can be improved thanks to information collected during the customer-product interaction, trying to reduce as much as possible the gap between what customer wants and the market offer.

Starting from the collection of a huge amount of data enabled by Digital Technologies, the solution allows to turn them into information to be communicated to people who can leverage on them. This makes business users able to take improving and corrective actions in a fast and easy way, increasing store efficiency and effectiveness performances.

Concerning costs, the main voices have been evaluated as well. Of course, the purchase of devices and software licenses represents one of the biggest expenses. Then, to implement the solution, after the physical installation of the devices, a functional study has to be carried out in order to understand how to deploy the solution in the specific real environment; the study focuses on understanding what are the particular needs of the player, what are the constraints to face and the configuration of both the devices and the IT modules to be integrated. To conclude, coding hours to connect data sources to SAP Cloud Platform and to Sales Cloud should be taken into account.

The solution is so feasible and provides retailers and CPG companies an opportunity for monitoring innovative KPIs to deepen the knowledge of the in-store shopping process, either from customers side analyzing their behavior and from products side analyzing their performances.

2. The Literature reviews

2.1 Introduction

A literature review is an evaluation of available scientific and non-scientific literatures, which includes the current knowledge, including substantive findings, as well as theoretical and methodological contributions to a specific topic.

The theme this thesis work develops concerns how the availability of digital technologies transforms retailers' stores and improves their performance management system and the ones of CPG (consumer packaged goods) companies.

In this work, the reviews have been carried out aiming at:

- providing an organized collection and classification of today-available documents considered available for the chosen area;
- getting an understanding of the current state of art and about the knowledge established by scholars and researchers;
- providing a summary of what is currently known and what is not;
- identifying uncovered areas of research;
- laying the groundwork for developing future question to investigate.

The chosen topic of investigation considers three main areas: Digital Innovation, Retail and KPIs.

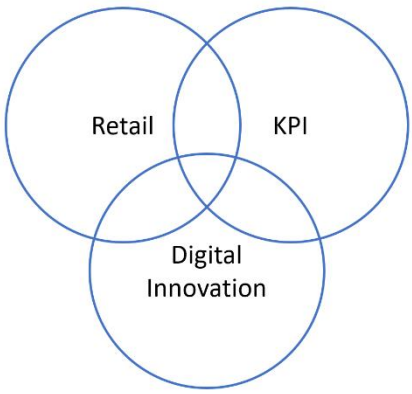


Figure 13. Areas of Investigation

Retail:

The word Retail refers to all the processes of sales of goods to end-users, in order to consume it and not re-sell the purchases. The Retail transaction happens at the end of the supply chain and is the ultimate link between manufacturers and final users. The goal of retailers is to make the purchase as easy as possible from a customer perspective: this is why in physical store salespeople are trained to help customers in choosing and buying items and, referring to e-commerce, websites are configured with pop-up chats to support visitors/customers while surfing on it. The interest in investigating this industry lays in the fact that, nowadays, many digital players are threatening traditional ones, eroding their market share; so, they have to undertake an innovation path to remain competitive.

Digital Innovation:

There are many different definitions of innovation. Innovation can be conceived as the process that converts concepts, ideas, thought into actions, products, services, emotions, status that have value for the customers of a specific market. The word digital refers to the new way of intending technology. Today technology is pervasive, able to create different everyday experience. It is multi-purpose, since there is a plethora of environments in which technology can be adopted. It is customer-centric, affecting many customers' touchpoints and is no more just a tool to carry out tasks, rather a relevant source of value. Digital Innovation topic has been deepened to understand the possibility of value creation stemming from the exploitation of new technologies and opportunities.

KPI (key performances indicators):

A key performance indicator is a measure that a company can leverage on in order to reach business objective. A KPI makes sense if it is meaningful by a business perspective and is able to turn a measure into a corrective and improving action. These indicators may have different level of detail: high-level ones give an idea of the performance of the overall business while low-level ones focus on processes. Nowadays companies have the possibility of gathering a huge amount of data and this allows to define new calculations to compare actual performances against targets. The ability of a company

lies in how to collect data and how to exploit them, even combining multiple sources. Studying this area allowed to know what the state of the art of performances measurement in Retail is and spot room for new KPIs.

The first part of literature review has consisted in the search and the selection of the today available papers (in particular, 40 scientific papers for example Elsevier Inc. and 15 non-scientific ones) written by researchers and scholars concerning the topics above mentioned, taking into consideration the Retail industry on global basis. Secondly, being the three topics chosen quite broad, a detailed framework has been defined aiming at providing an overview of the papers selected in an organized way. This helps in identifying gaps, understanding what has already been investigated and hint new research topics. Thirdly, investigation coverage is analyzed, and questions developed.

The analysis of these three areas, the identification of current points of the intersection and overlapping as well as potential gaps are objectives of this literature review. The scope of this work is to fulfill the literatures' gaps developing an innovative solution ready to be implemented by every retailer or CPG company.

This chapter answer to the research question "*How do both the scientific literature and the non-scientific one debate on the thematic of Digital Innovations related to Performance Measurement in Retail Industry?"*

2.2 Research methodology

2.2.1 Scientific papers selection and classification

Papers have been searched using search engine Google, Google Scholar and academic library database of Politecnico di Milano (www.biblio.polimi.it). For Digital Innovation, Retail and KPIs specific keywords have been selected and used to find the right papers for this research work. Being Digital Innovation (DI) the widest topic among the three, DI documents contextualized to Retail only have been selected: this means that only Digital Innovation already applied in Retail environments or trend applicable in future in this industry have been considered. Some of the keyword used are: "retailing", "store innovation", "in-store Digital Innovation", "retail trends", "in-store digital technologies",

"retailers' key performance indicators", "in-store customer experience", "Store KPI"; "Innovative KPI in Retail" and so on.

Among different papers relevant per topic, only the ones up to date have been chosen. This literature review considers the papers written not before than 2010 to be aligned with the current scenarios.

In total, 40 scientific papers have been collected and a framework has been developed to organize them in a clear way to analyze contents and characteristics. The image below shows the framework.

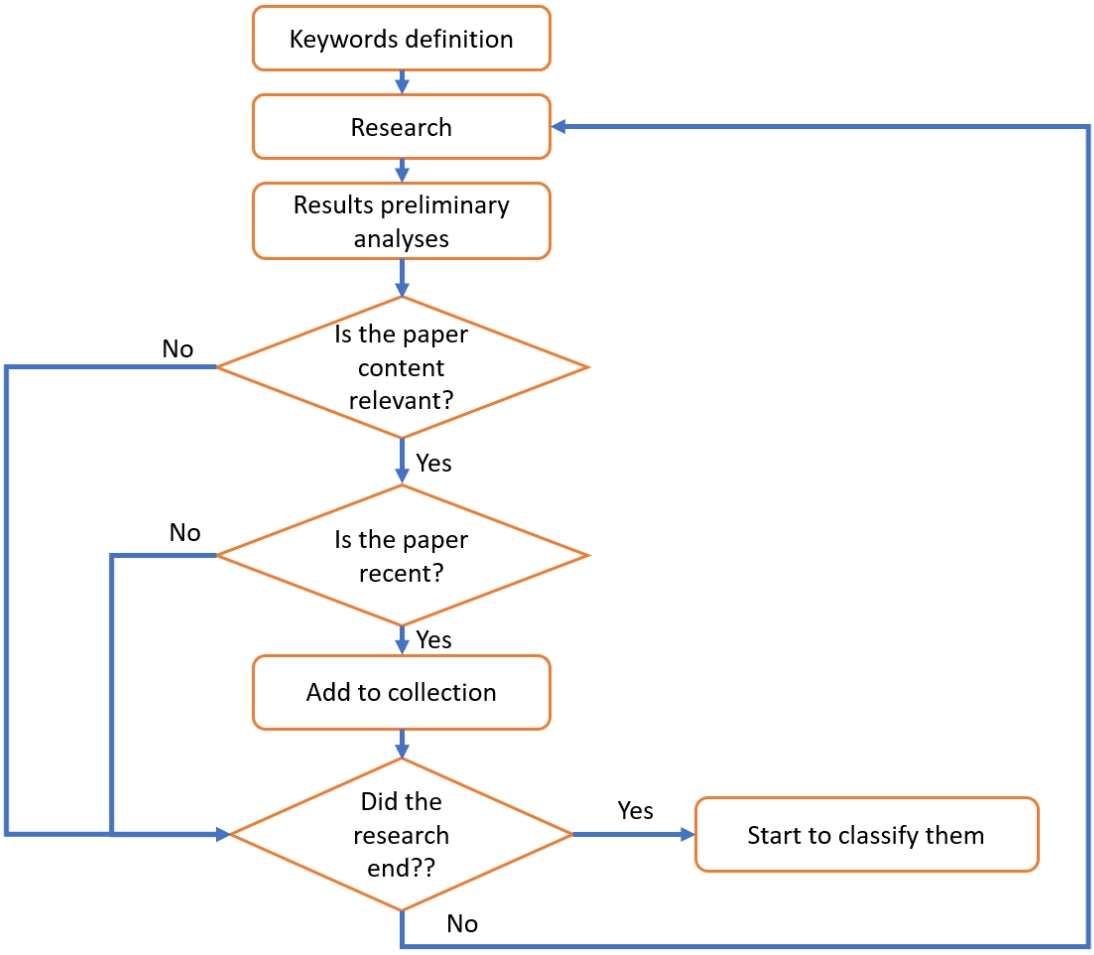


Figure 14. Literature Papers Research Framework

The framework developed to organize all documents collected considers different aspects:

1. general information of the document (title, year, author, source)
2. content covered (Retail, Digital Innovation, KPI)

3. methodology
4. KPIs analysis
5. innovation purpose
6. type of innovations
7. industry
8. analyzed market

Content covered refers the topic discussed in the document (DI, Retail, KPI). Of course, the three topics could be intertwined and overlapped.

Methodology refers to how papers have been redacted. Each paper could follow a quantitative approach, a qualitative one or even both of them.

Quantitative approach considers:

- mathematical or statistical model
- survey or questionnaire
- experiment

Quantitative approaches aim at providing mathematical evidence of a specific thesis to the reader. Different algorithms are included in the documents such as linear regression (to study the relationship and the dependency of one or more variables on a chosen one) that could be simple or multiple, ANOVA, and analysis of data in general. Mathematical or statistical models try to represent a tool a player could rely on to understand current performance and to best evaluate next decisions. Surveys and questionnaires have the goal of understanding the perception of a target on a phenomenon. Finally, experiment is useful in order to test new ideas, solutions and, through the analysis of results, getting insights, understanding errors and identifying corrective actions.

Qualitative approach considers:

- descriptive papers
- case study
- framework
- focus group or interview
- comparison

Qualitative documents aim at providing a description of a phenomenon or a research. Sometime qualitative papers want to investigate deeply a result given by a quantitative method. For example, a paper could describe the output of a focus group conducted to deepen a result of a survey. Qualitative methodology could be useful also when referring to aspects not so easily measurable (e.g. emotions, attitudes).

Concerning the KPIs, papers have been classified considering their relativeness with efficiency or effectiveness.

Then, papers covering KPI have been categorized analyzing the phase of the shopping process to which they refer (purchase and post-sale).

Finally, a further categorization of papers covering KPIs has been inserted according to the target of KPIs discussed:

1. *Product*: KPIs of this type are useful to understand performance against target of a single or a category of products (e.g. level of satisfaction of a product, average batch purchased…)
2. *Transactional*: KPIs company can get data needed from transactions (e.g. sales of a specific product)
3. *Customer*: KPIs providing information related to the behavior, the thoughts, the emotions of the customer (e.g. average time spent in the store)
4. *Area*: KPIs of this type, provide evidences of characteristics/performance of what happens in a specific area of the store during the shopping (e.g. avg level of queue in front of a shelf, max queue length, …)

Concerning the Digital Innovation coverage, Innovation purpose has been categorized in Customer Experience (sub-categories are customer loyalty, engagement, experience, knowledge) and Performance Measurement (sub-categories are efficiency, effectiveness and creation of value). Then the type of technology the innovation is based on is specified and the phase in which it is implemented as well (i.e. pre-sale, purchase, post-sale).

Finally, a classification regarding the industry the document refers to and the market analyzed has been provided for each paper.

A total of 40 papers coming from different academic and research sources has been collected. Among most relevant sources there are:

- Elsevier Inc
- Business Horizons (part of Elsevier Inc)
- Journal of Retailing
- Journal of Business Research
- International Journal of Research in Marketing
- European Journal of Operational Research
- Journal of Retailing and Consumer Services
- Marketing Science
- International Journal of Computational Intelligence Research
- The international Journal of Logistic Management
- International Journal of Retail and Logistics Management
- Journal of Fashion Marketing and Management
- Journal of Economics and Management Strategy

As already mentioned in the previous section, all papers have been published not before than 2010 (just one paper is of this year, two are of 2013 and all the others are published more recently).

The following images shows the classification framework, first in a tree diagram and second in excel file.

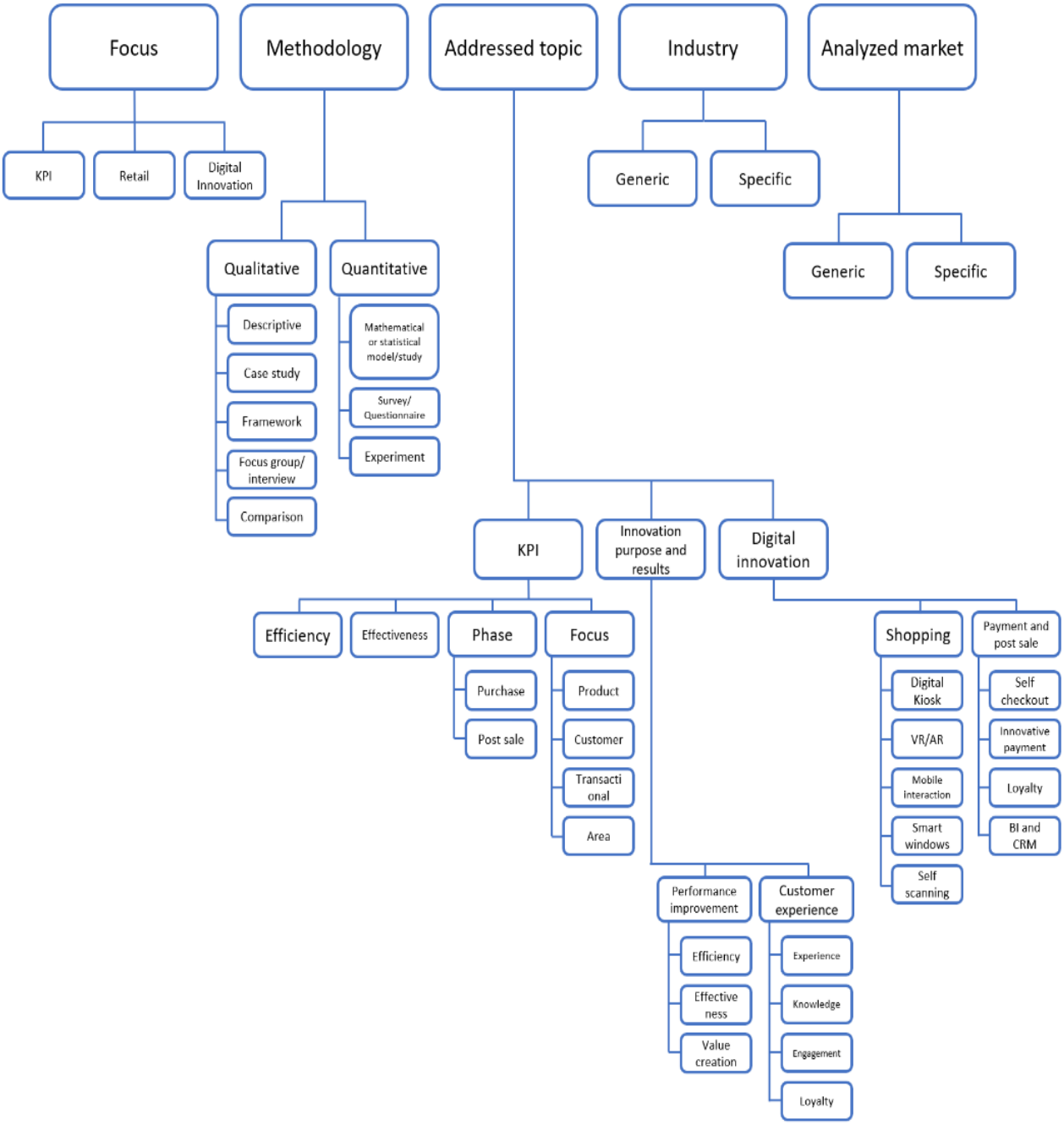


Figure 15. Documents Classification Framework

					FOCUS		
#	TITLE	SOURCE	YEAR	AUTHOR	DIGITAL INNOVATION	RETAIL	KPI
1	The Internet of Things (IoT) in retail: Bridging supply and demand	Business Horizons	2018	Felipe Caro, Ramin Sadr	X	X	
2	Do Digital Displays Enhance Sales? Role of Retail Format and Message Content	Journal of Retailing	2015	Anne L. Roggeveena, Jens Nordfältb, Dhruv Grewal		X	X
3	Happy grocery shopper: The creation of positive emotions through affective digital signage content	Technological Forecasting & Social Change	2016	Marion Garaus, Udo Wagner, Sandra Manzinger		X	

Figure 16. Papers Classification Worksheet Part 1

METHODOLOGY							
QUANTITATIVE			QUALITATIVE				
MATHEMATICAL OR STATISTICAL MODEL/STUDY	SURVEY / QUESTIONNAIRE	EXPERIMENT	DESCRIPTIVE	CASE STUDY	FRAMEWORK	FOCUS GROUP / INTERVIEW	COMPARISON
			X		X		
X		X					
		X					

Figure 17. Papers Classification Worksheet Part 2

ADDRESSED TOPIC													
KPI							INNOVATION PURPOSE AND RESULT						
EFFECTIVENESS			FOCUS				PERFORMANCE IMPROVEMENT			CUSTOMER EXPERIENCE			
	PURCHASE	POST-SALE	PRODUCT	CUSTOMER	TRANSACTIONAL	AREA	EFFICIENCY	EFFECTIVENESS	VALUE CREATION	CUSTOMER EXPERIENCE	CUSTOMER KNOWLEDGE	CUSTOMER ENGAGEMENT	CUSTOMER LOYALTY
							X		X	X			
X	X				X								
X													X

Figure 18. Papers Classification Worksheet Part 3

DIGITAL INNOVATION								
	SHOPPING				PAYMENT AND POST SALE			
DIGITAL KIOSK	INNOVATION BASED ON VIRTUAL OR AUGMENTED REALITY	MOBILE INTERACTION IN STORE	SMART WINDOWS	SELF SCANNING	SELF CHECK OUT	INNOVATIVE PAYMENT	LOYALTY	BUSINESS INTELLIGENCE AND CRM
		X						X
			X					

Figure 19. Papers Classification Worksheet Part 4

INDUSTRY		ANALYZED MARKET		ABSTRACT
GENERIC	SPECIFIC	GENERIC	SPECIFIC	
X		X		A sales channel serves two primary functions: delivering information and products to customers. Omnichannel retailing allows for the decoupling of these two functions as consumers can learn about products through channels that differ from those used to purchase them. This separation requires a sophisticated inventory and supply chain operation, as well as integration of all customer touchpoints, in order to match fast-moving supply and demand. The Internet of Things (IoT) can play a fundamental role in channel integration because it allows companies to rebalance supply and demand. We classify IoT initiatives on an opportunity map, presenting a strategic framework that distinguishes initiatives by the value they create and by their major area of impact. We justify the adoption of IoT in terms of its enabling capabilities—those immediately realized by deploying IoT sensor data—but its true potential resides in its enhancing capabilities—unanticipated benefits following IoT adoption—at the intersection of supply and demand.
X			SWEDEN	This research examines the impact of in-store digital displays on retail sales across four different store formats. The results of three fieldexperiments show that sales in hypermarkets are enhanced when digital displays are on. However, in supercenters and supermarkets, having thedigital displays on has a minimal effect on sales, and in smaller stores (e.g., convenience stores), the digital displays have a negative impact onsales. A follow-up study confirms that the lift in sales in larger stores when the digital displays are on continues five months after their initialinstallation, though the lift does diminish somewhat. Furthermore, for the digital display to result in a sales lift, the message content must
X		X		Recent research has identified digital signage (DS) as a promising element for creating atmospheric value. However, extant studies have explored shoppers' reactions to DS showing advertising content in hedonic shopping environments. Considering the potential of utilitarian shopping situations to evoke negative emotions, the current research investigates whether DS positively affects consumers' responses in task-oriented shopping situations. In doing so, it incorporates assumptions from the limited capacity model and resource matching theory into a theoretical framework to explain how task-relevant DS content influences impulse purchases and store loyalty. This relationship is mediated by emotional and cognitive processes. By drawing on findings from prior studies, this research further differentiates the effects of cognitive, affective, and mixed DS content on consumer responses. A field experiment tests the theoretically derived responses. The findings suggest that affective DS content creates positive emotions and increases impulsive purchases and store loyalty.

Figure 20. Papers Classification Worksheet Part 5

2.3 Literature analysis

2.3.1 Scientific Literature Analysis

After having organized the general info of the papers under analysis in the framework, topic coverage has been compiled. Digital Innovation, Retail, and KPIs may overlap; consequently, papers could have been classified in more than one topic, and some of them cover all three. The following image shows the list of papers covering all the three topics.

Mobile marketing: A literature review on its value for consumers and retailers	Elseviere Inc.	2013	Roger Ström, Martin Vendel, John Bredican
In-store proximity marketing: experimenting with digital point-of-sales communication	International Journal of Retail & Distribution Management	2017	Kim Willems, Malaika Brengman, Stephanie van de Sanden
The Future Role of Digital Technologies In Emerging Technology-Based Retail Environments	U- and E-Service, Science and Technology	2015	Stefano Sorace , Eleonora Pantano, Constantinos-Vasilios Priporas, Gianpaolo Iazzolino
Vision (im)possible? The effects of in-store signage on customers' visual attention	Elseviere Inc.	2014	Tobias Otterbring, Erik Wastlund, Anders Gustafsson, poja Shams
Developing a framework to improve virtual shopping in digital malls with intelligent self-service systems	Elseviere Inc.	2014	Haluk Demirkan, Jim Spohrer

Figure 21. Scientific Papers Covering 3 Areas of Investigation

Then, the general coverage of Areas of Investigation is presented in the following graph.

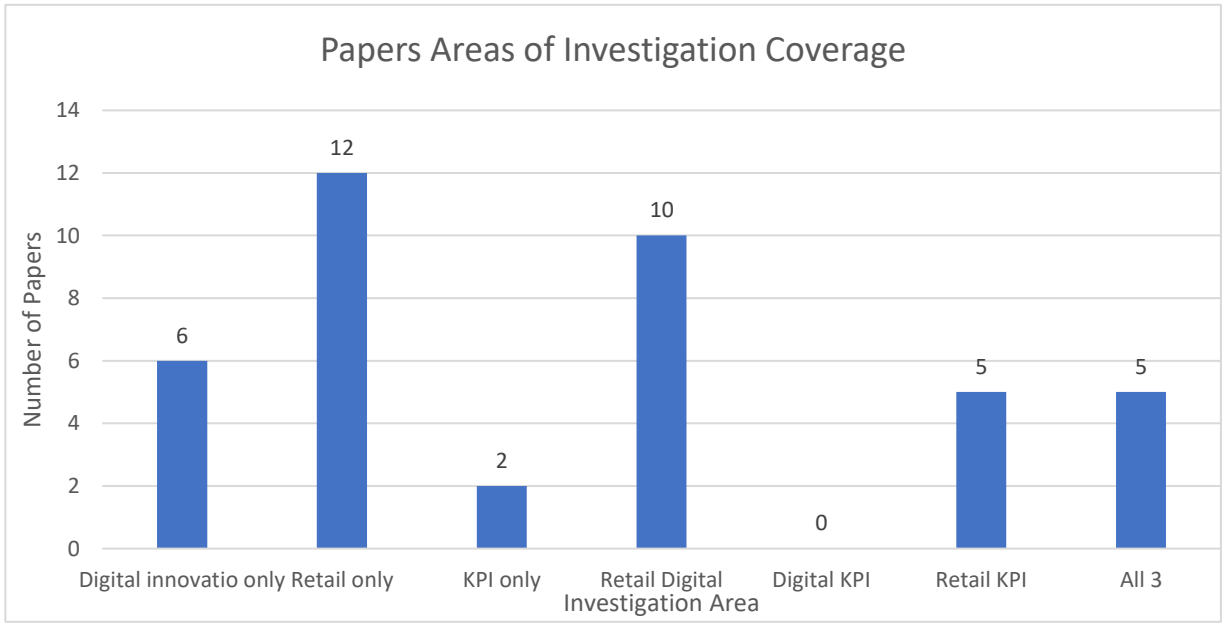


Figure 22. Papers Areas of Investigation Coverage. Numbers refer to how many papers cover a specific area or intersection

It is possible to notice that the number of documents covering KPIs topic only is just 2. Moreover, there is no document that discuss something cross between Digital Innovation and KPIs, highlighting maybe that KPI today in use in Retail context are not stemming from or enabled by innovative technologies.

The documents selected have an equilibrium from a methodology perspective; there is a similar number of papers following a qualitative approach and a quantitative one. 10 out of 40 apply both a quantitative methodology and a qualitative one.

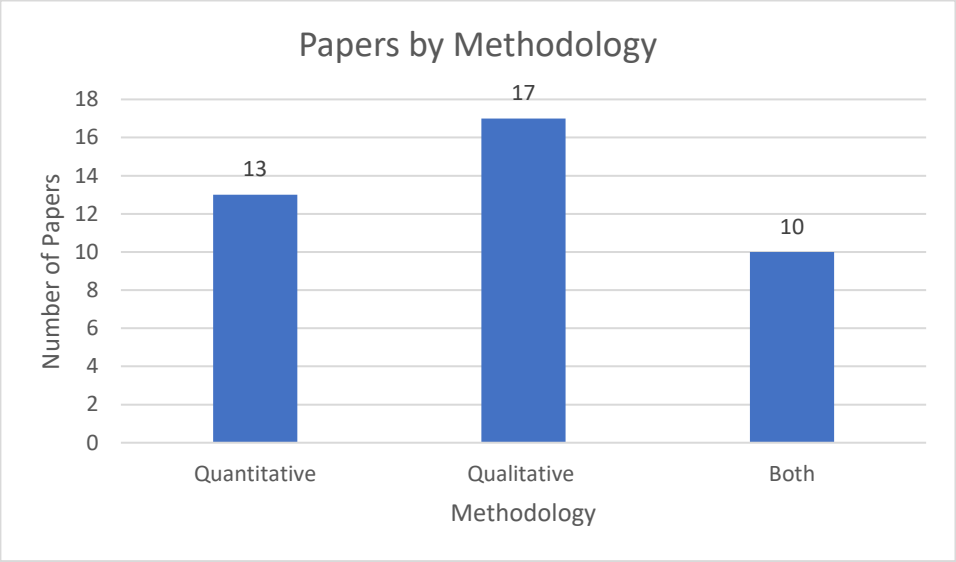


Figure 23. Papers by Methodology. Numbers refer to how many papers are related to a specific methodology

Regarding the quantitative documents, the most used approach is the development and study of a mathematical model to find the relation between independent variables and a chosen one.

Concerning the qualitative methodology, the most used approach is the one of the descriptions, adopted by 17 out of 40 papers.

The following graphs show the classification of papers according to quantitative subclasses and qualitative ones.

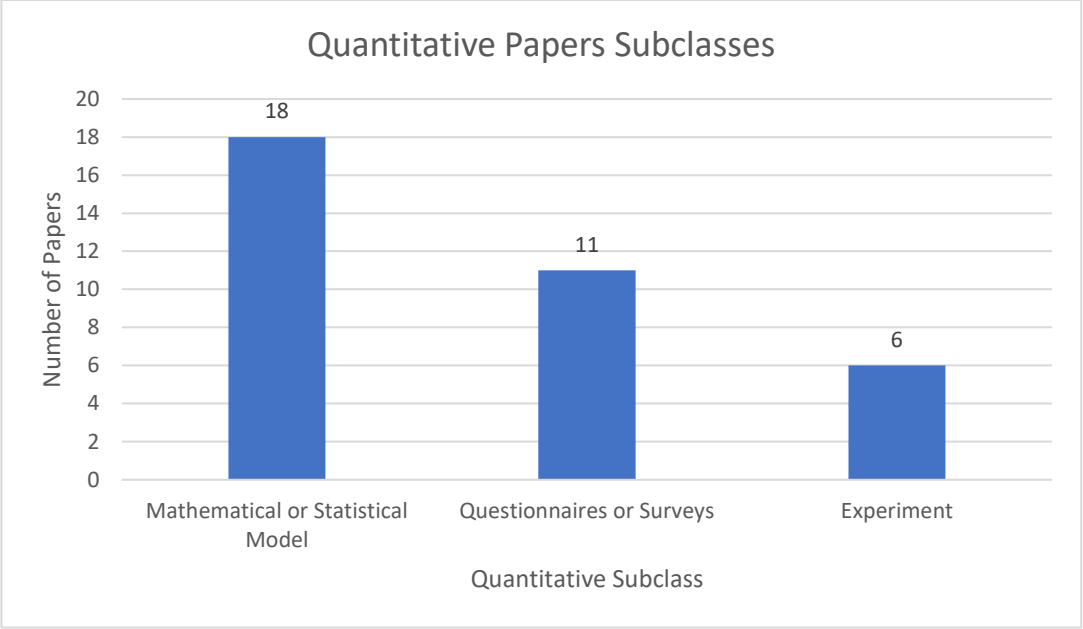


Figure 25. Quantitative Papers Subclasses. Numbers refer to how many papers have been classified in a specific subclass

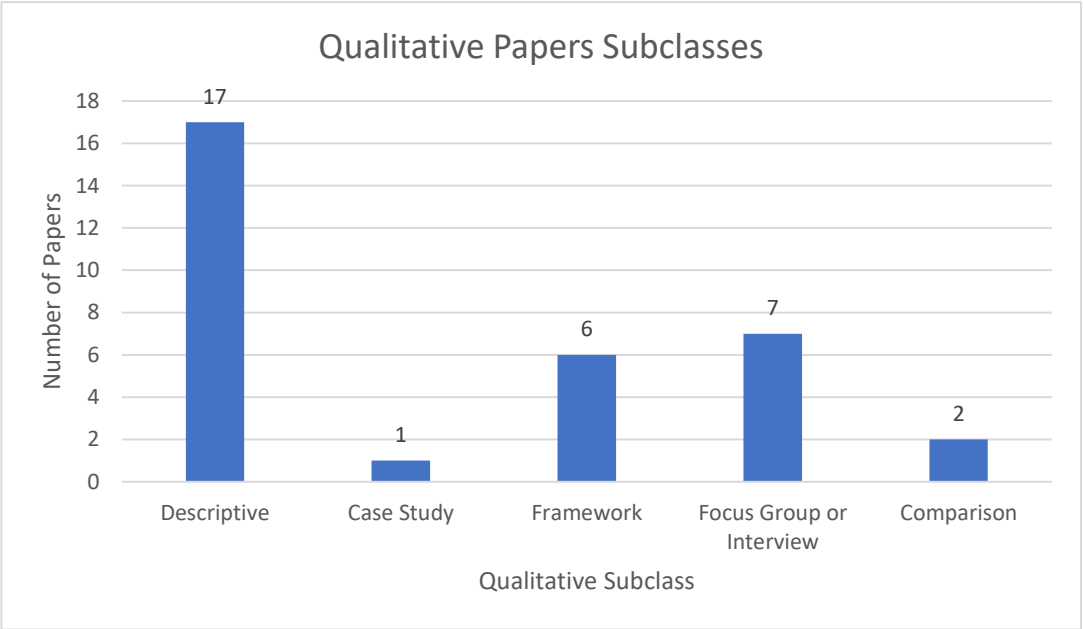


Figure 24. Qualitative Papers Subclasses. Numbers refer to how many papers have been classified in a specific subclass

Concerning innovation purpose and results, different options have been found: regarding performance improvement, papers have been classified according to efficiency, effectiveness and value creation; regarding customer experience, the experience itself, the customer knowledge, the customer engagement and the customer loyalty have been identified as main aspects. In particular, Customer experience is considered as the entirety of the interactions a customer has with a company and its products. The overall experience reflects how the customer feels about the company and its offerings. Customer knowledge is considered as the combination of experience, value and insight information which is needed, created and absorbed during the

transactions and exchanges between customers and enterprise. Customer engagement is a business communication connection between an external stakeholder (consumer) and an organization (company or brand) through various channels of correspondence. This connection can be a reaction, an interaction, effect and overall customer experience, which takes place both online and offline. Finally, customer loyalty is considered as the extent to which customers are devoted to a company's products or services and how strong is their tendency to select one brand over the competition. The following graph shows the innovation and purposes results breakdown.

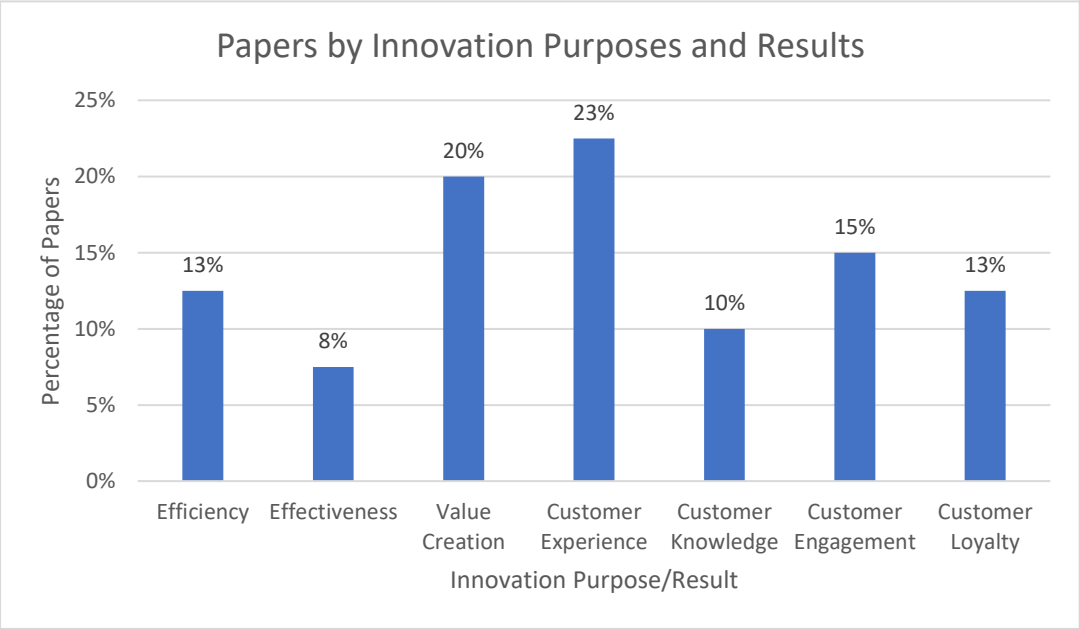


Figure 26. Papers by Innovation Purposes and Results. Percentages refer to % of paper aiming at a specific purpose or result

Customer experience and value creation are the main addressed topics (20% and 23%), consistent with the current trends showing a shifting in the value creation process, from upstream (company) to downstream (customers). Customer knowledge, engagement and loyalty are almost similarly covered by papers, respectively 10%, 15% and 13%. Efficiency and effectiveness are investigated by 13% and 8% of papers. Since an innovation may have different purposes, it is not rare to find a paper taking into account different topics. A clear example of a paper belonging to this area (covering different topics) is "*Revisiting the supermarket in-store customer shopping experience*" by Nic S. Terblanche and published by Elsevier Inc. This paper investigates how different aspects of in-store customer experience affect customer satisfaction (which is correlated to customer engagement) and therefore customer loyalty. The author identified six

elements which constitute the in-store customer shopping experience in a supermarket and set hypotheses over each of them. For instance, the elements are:

1. Merchandise value: the result of the perceived merchandise price, merchandise quality and that merchandise value has a positive influence on re-patronage intentions (Baker et al. 2002).

2. Internal shop environment: both the décor and in-store physical facilities and amenities such as check-out counters, display shelves and promotional displays. The floor layout of the shop, product and service groupings, shelf space allocation, product locations and their role to encourage buying, also form part of the internal shop environment factor. According to Mohan et al. (2012), an effective shop layout will stimulate more in-store exploration by customers leading to other positive outcomes such as satisfaction.

3. Interaction with staff: according to Bitner et al. (1994), customer satisfaction is often influenced by the quality of the interpersonal interaction between the customer and contact employees. Relationships between employees and customers that increase rapport and employee responsiveness have led to greater customer satisfaction (Menon et al., 2000).

4. Merchandise variety: Donovan et al. (1994) found that a cognitive factor such as the variety of merchandise, leads to positive customer behavior such as spending more money and time than planned in a shop, that is, if customers are satisfied with the merchandise variety.

5. Presence of an interaction with other customers: Pons et al. (2016) mentions that other customers may contribute to a pleasant experience and in certain situations, crowds can also activate positive experiences for customers and yield positive returns for businesses in the process.

6. Customer in-shop emotions: Donovan and Rossiter (1982) found that customers' in-store emotions influence the likelihood of future patronage, while Dawson et al. (1990) believe that emotions experienced in the Retail marketplace affect preference and choice and that positive emotions should initiate customer satisfaction.

Respectively, the six hypotheses he set are:

- H1: There is a positive relationship between merchandise value and customer satisfaction.

- H2: There is a positive relationship between the internal shop environment and customer satisfaction.

- H3: There is a positive relationship between interaction with staff and customer satisfaction.

- H4: There is a positive relationship between merchandise variety and customer satisfaction.

- H5: There is a positive relationship between the presence of and interaction with other customers and customer satisfaction.

- H6: There is a positive relationship between customer in-shop emotions experienced by customers and customer satisfaction.

With a questionnaire made by a random sample of 10.000 persons, the author assessed that these hypotheses were satisfied, developing a confirmatory factor analysis to verify the results. Furthermore, an additional hypothesis has been added and verified:

- H7: There is a positive relationship between customer satisfaction and customers' re-patronage intentions.

Here's below the hypothetical model:

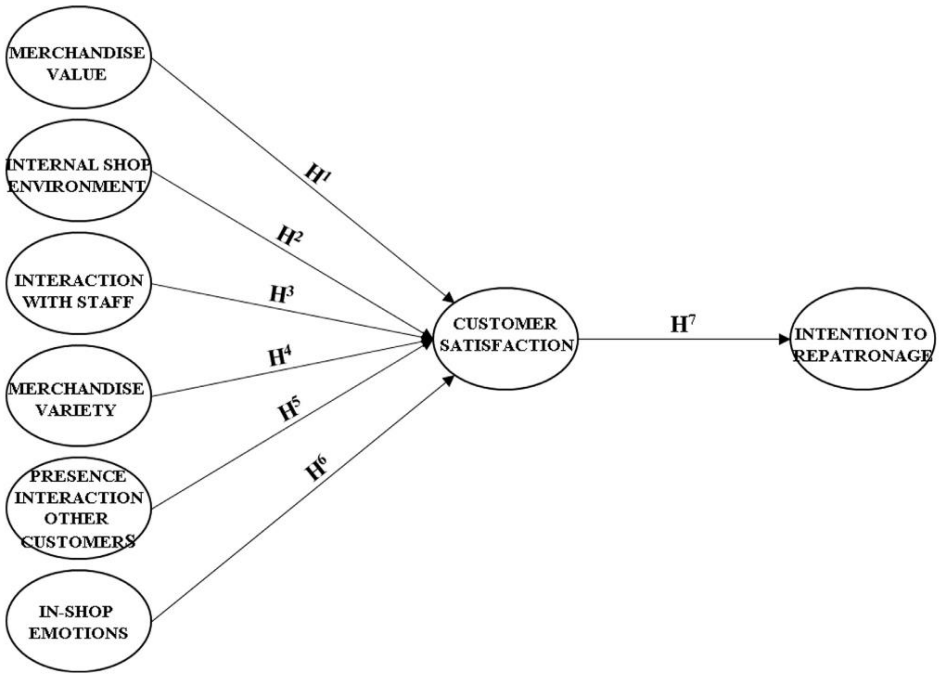


Figure 27. Hypothetical Model

Concerning Digital Innovations, the papers cited, studied and analyzed have been classified according to the two main phases of the purchase process:

1. Shopping phase
2. Payment and post-sale phase

Regarding shopping phase, the Digital Innovations considered were:

- Digital Kiosk: a computer terminal (usually positioned before the store entrance) featuring specialized hardware and software that provides access to information and applications for communication, commerce, entertainment, or education.

- Innovation based on virtual or augmented reality: Virtual reality (VR) is an experience taking place within simulated and immersive environments that

can be similar to or completely different from the real world. Augmented reality (AR) is an interactive experience of a real-world environment where the objects that reside in the real-world are enhanced by computer-generated perceptual information, sometimes across multiple sensory modalities, including visual, auditory, haptic, somatosensory and olfactory.

- Mobile interactions in store: all mobile technologies which allows customers to interact with the store and its components or with other people inside it.

- Smart windows: in-store windows showing customers product information or commercials and interacting with them.

- Self-scanning: an automated process that enables shoppers to scan a product barcode in order to add it to the shopping list or to get information.

The graph below shows the shopping phase Digital Innovation breakdown.

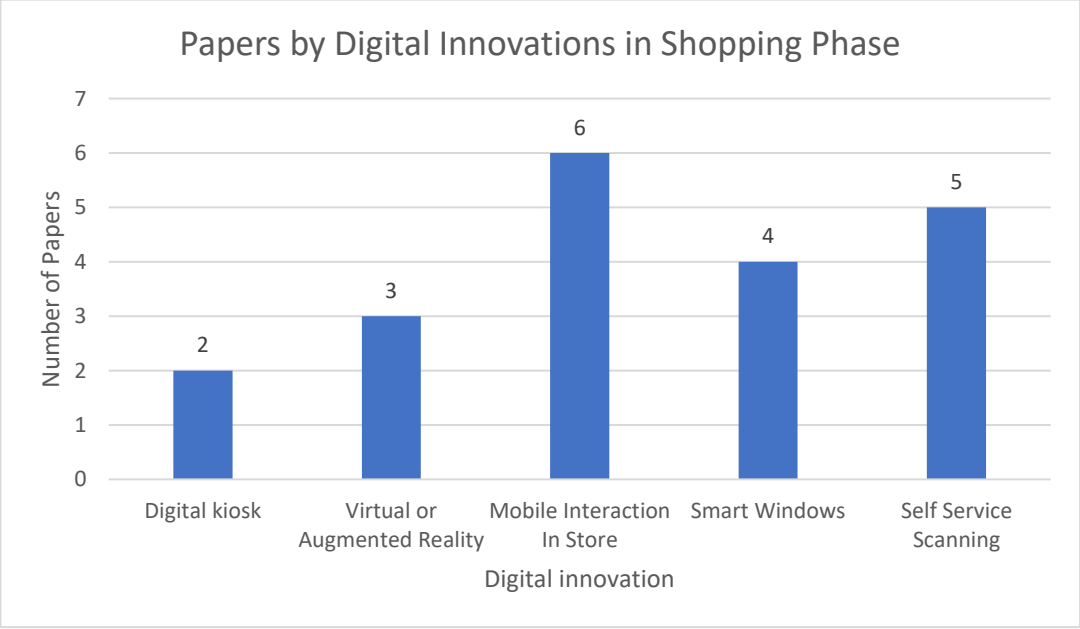


Figure 28. Papers by DI in Shopping Phase. Numbers refert to how many papers address a specific DI

Regarding payment and post-sale phase, the Digital Innovations considered were:

- Self-check-out: an automated process that enables shoppers to scan, bag, and pay for their purchases without human assistance.

- Innovative payment: includes all dematerialized payment systems where you use no coins or banknotes.

- Loyalty: includes all tools and instrument fostering customer loyalty and enabled by Digital Innovations.

- Business intelligence and CRM: it comprises the strategies and technologies used by enterprises for the data collection, customer management and data analysis of business information.

The graph below shows the payment and post-sale phase Digital Innovation breakdown.

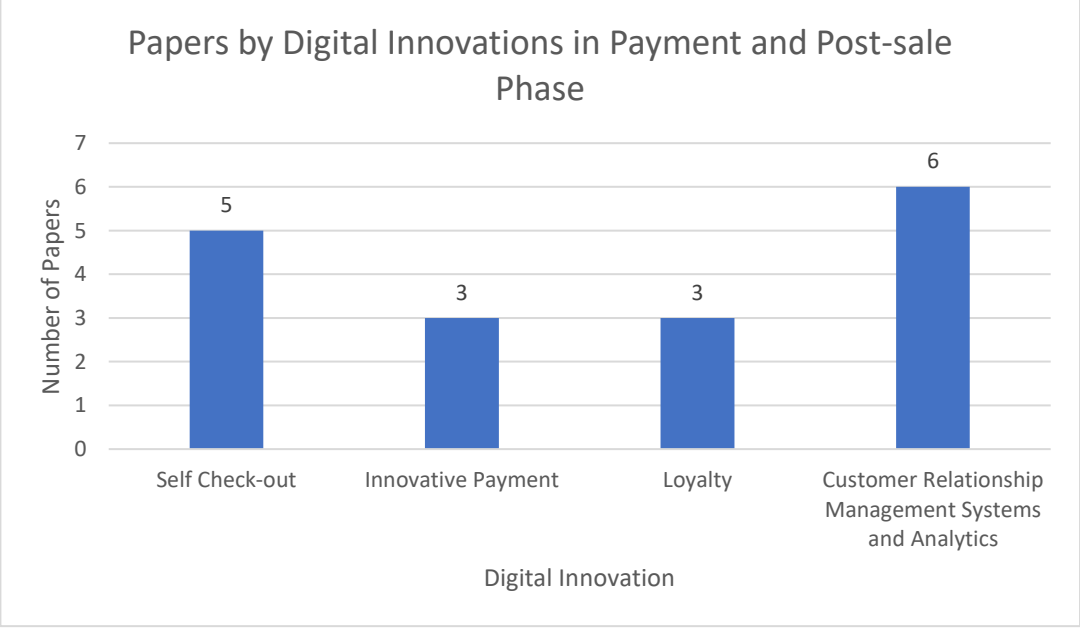


Figure 29. Papers by DI in Payment and Post-sale Phase. Numbers refer to how many papers adress a specific DI

Focusing on the analysis of papers discussing Digital Innovation, payment and post sales innovations are discussed almost as much as ones related to previous stages of the shopping path, as it is possible to notice in the graph. This highlights the strong interest in innovation in payments and fintech.

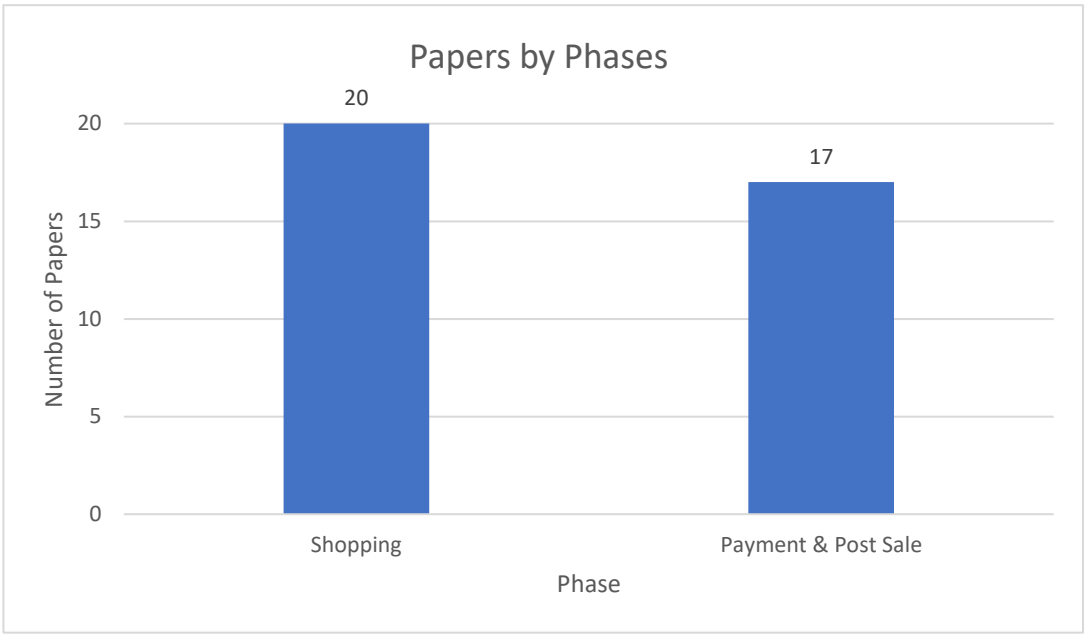


Figure 30. Papers by Phases. Numbers refer to how many papers focus on a specific phase

Moving to the analysis of KPIs discussed, in this work they have been classified according to the macro-phases of the shopping process: purchase process and post-sales. From the graph it is possible to see the phase breakdown.

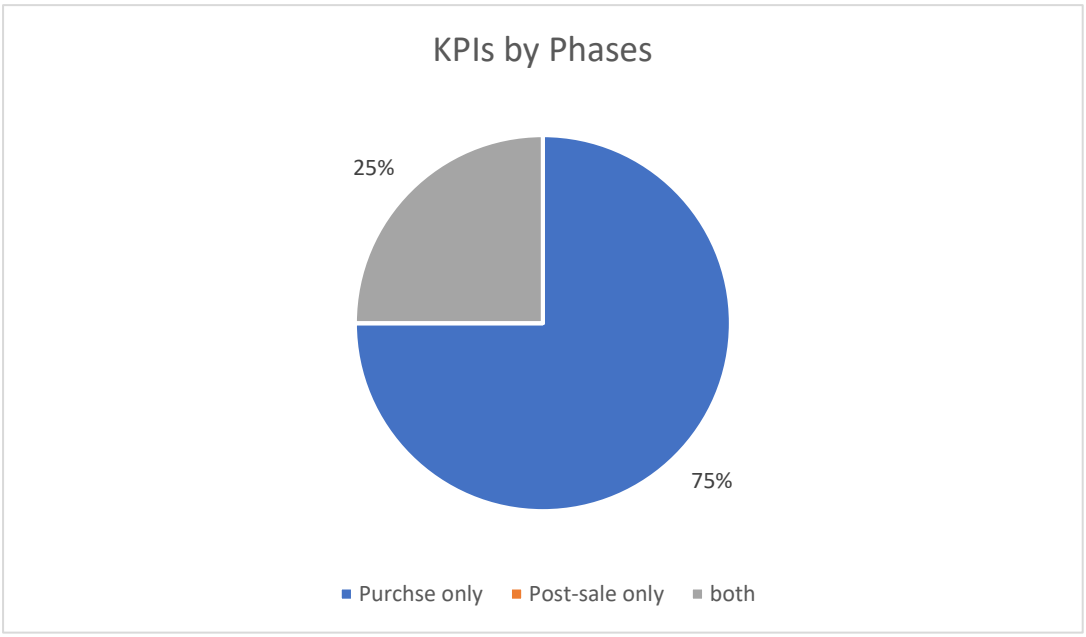


Figure 31. KPIs by Phases. Percentages refer to % of papers discussing KPIs addresses a specific phase

As it is possible to see from the graph, the 75% of papers covering KPIs refers to purchase only situation, while the remaining 25% discuss KPIs referring both to purchase situation and post-sales ones. This means that all papers selected in this literature review refer to KPIs in purchase process. But it is mandatory to provide a clarification; a KPI to have sense must be measurable and must be versatile to get in the technological context of the player (Retailer or CPG companies) that adopts the KPI. In these documents, multiple experiments are carried out to spot the correlation between different variables (e.g. in paper “Do digital displays enhance sales?” the correlation between the level of sales of the adoption in the store of digital displays has been studied) and generally to provide an analysis of the performance (results of the experiment). These experiments could be considered as stand-alone and do not consist a solution effectively implementable by a retailer or a CPG company inside a store, because do not consider technological dependencies and constraints of the retailer.

2.3.2 The non-scientific analysis

The second part of the analysis focuses on non-scientific papers, that are documents, reports or articles written for the mass-public use and that have not a primary academical purpose. The same analysis and classification of scientific papers has been done. 16 papers have been selected. The sources are mainly two: from one side consulting or technology companies, in particular Accenture, PriceWaterhouse Cooper, McKinsey&Company, KPMG, Engineering, Oracle, Microsoft and JD Technology; from the other side research companies like Retail Touchpoint, Tableau, Osservatorio Innovazione Digitale nel Retail of Politecnico di Milano , Alliance Data, CB Insights and Salesforce Research.

The majority of these papers (13 out of 16) addresses Retail and Digital Innovation topics, while the remaining part addresses KPIs. This is due to the fact that technologies and Digital Innovations are nowadays changing the Retail word, riding or even creating trends which companies' study or focus on before publishing their reports or articles. The nature of these papers, as it is possible to notice in the graph, is mainly qualitative, describing or comparing innovative technologies and trend affecting Retail world.

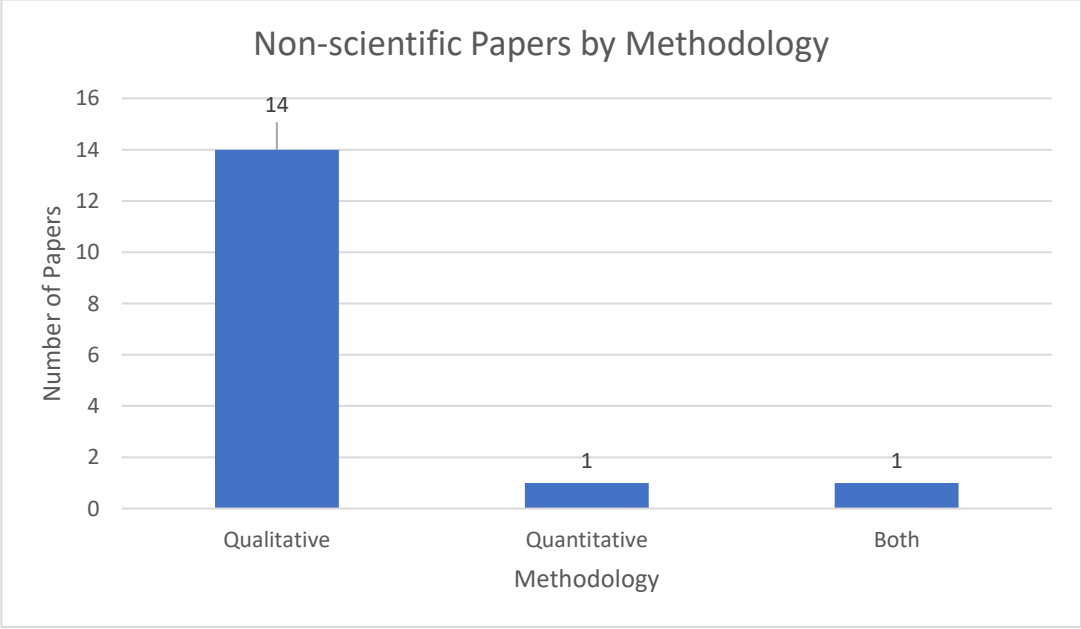


Figure 32. Non-scientific Papers by Methodology. Numbers refer to how many papers address a specific methodology

The papers addressing KPIs topic mainly investigate effectiveness aspects over efficiency ones, covering both the purchase phase (in store) and the post purchase one. In detail

it is analyzed how the introduction of innovations could affect either the key performances of a Retailer and the improvement strategy beyond them.

The graph shows how many times Digital Innovations are analyzed in the papers: immediately it is notable that Artificial Intelligence is the most addressed one thanks to the efficiency and effectiveness benefits coming from its different applications. Mobile payment innovations, even if they are not mature technologies, but already implemented in the Retail world, are less investigated; on the other side, innovations related to in-store interaction and Virtual or Augmented Reality are hot topics. All these technologies allow the retailer to collect more and more data form customers, feeding their CRM systems and challenging the Analytics with big data interpretation.

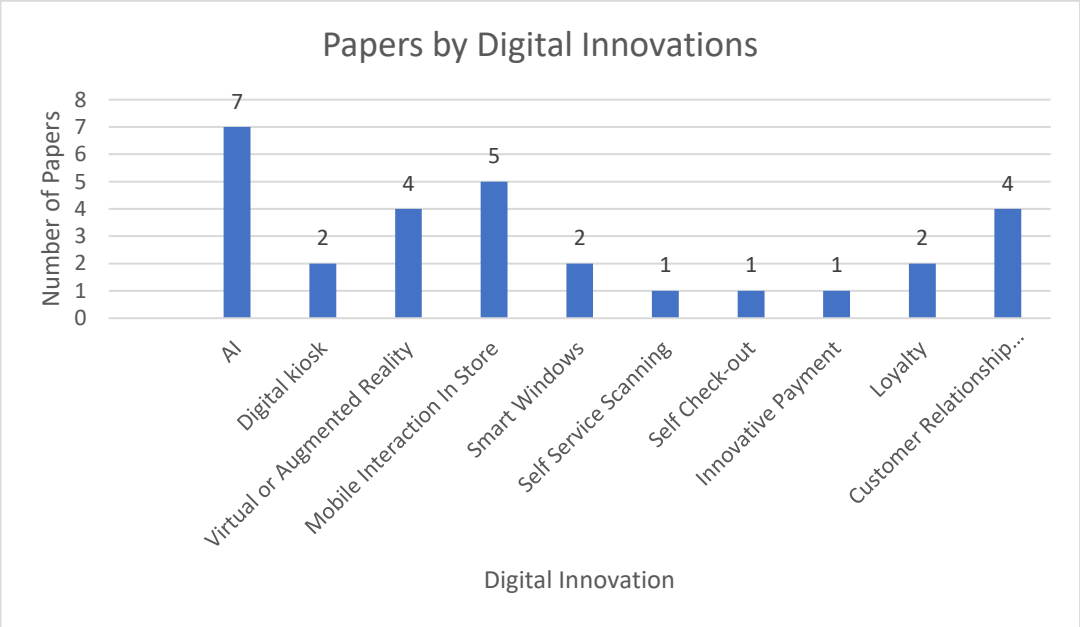


Figure 34. Papers by DI. Numbers refer to how many papers address a specific DI

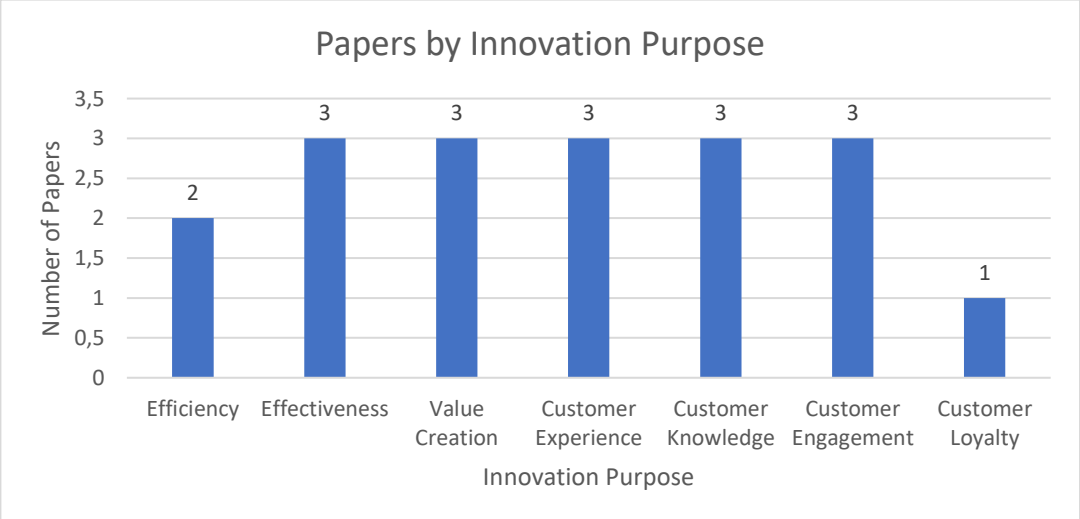


Figure 33. Papers by Innovation Purpose. Numbers refer to how many papers address a specific purpose

Analyzing the purposes of the innovations, they are deepened in a more homogeneous way in respect to the Digital Innovations classification: looking at the graph it is possible to see that there is a great interest towards customers in terms of value creation, engagement, the experience and the knowledge; this is consistent with the actual trend that sees a shift in the value creation chain from upstream to downstream, from the production to the customer.

Generally, apart from one paper, the companies do not focus neither on a specific Retail industry, nor on a market, enforcing the fact that the studied innovations, KPI and trends are relevant for the whole industry.

2.3.2 Non-scientific papers takeaways

From the analysis of non-scientific papers, it is possible to identify different takeaways which summarize what consulting, technology and research companies assess in their reports:

1. Customer experience is (expected to be) everywhere: nowadays, customers expect to live an omnichannel experience. Starting from home, through mobile devices enabling them either to view the entire offer dedicated or directly purchase; then, in-store, both with new type of interaction with the store, the shelves and the product and with a real-time and customized offer dedicated to them; this offer is not limited to products, but it is integrated with complementary services/experiences based on the customer profile; the experience moves to new payment methods which “lean” the process eliminating non-value-added activities; it finishes again out of store with digital, fast and efficient after-sales services. The retailers able to delivery this kind of experience are the one who will have a higher level of customer engagement and loyalty and therefore higher effectiveness performances.

2. Digital technologies are changing the Retail world: in the last years, the first digital technologies were not greatly exploited inside retailers. Today, technologies like Artificial Intelligence, Machine Learning, Virtual Reality, Path and Sentiment analysis

tools are gaining momentum, while some of those one enabling digital interactions in-store are already in the implementation phase. They provide the retailer with the possibility of collecting new types of customer data along the entire purchase process (before, during and after purchase), of interacting in a digital and innovative way with them and consequently of enabling a real-time, customized and omnichannel experience, which, as mentioned before, is key for a retailer success. In addition, those technologies would allow the retailer to measure new KPIs, which nowadays are not able to be monitored.

3. Big data are essential for retailers: collecting customer data is complex for them. As said before, data are crucial for the delivery of a real-time, customized and omnichannel customer experience and for enlarging the KPIs measurement system. Today, brick and mortar retailers barely own data of an individual customer (usually they own aggregated data); retailers who leverage on a loyalty campaign (e.g. loyalty card) could know data on the single customer, but only ex-post (after the check-out) and rarely those data are exploited for the delivering of a customized experience. Digital and innovative technologies together with Big Data analytics could potentially allow the retailer to create one to one marketing campaign, which for the final customers represent a real value-added experience.

From the non-scientific literature emerges clearly which will be the strategic direction retailers should follow in the next years, that is to embrace opportunities stemming from the adoption of new technologies. At now, how retailers could start moving towards this scenario? Which technologies are already available and implementable? How and which are the benefits coming from the creation of an Innovative KPIs Measurement System?

2.4 Gap identification

The last part of the literature review focuses on the identification of potential gaps, which are topics (among the analyzed ones, Retail, Digital Innovation and KPI, with the relative sub-classes) less investigated nowadays by the literature itself. At topic level, a potential gap concerns KPI analysis: while Digital Innovations in Retail industry are amply investigated by the current scientific and non-scientific literatures, KPIs study and analysis result less deepen; the reason behind that stands in the fact that most of the monitored KPIs are the traditional ones, considered less interesting than the analysis of innovative digital technologies. As already said in the review, however the great part of KPIs focuses on the purchase phase, in the KPI-focused paper "only" experiments have been conducted with the objective of analyzing how some conditions inside the store (promotional displays, totem, type of scent and music) or some customer traits (age, gender, social class, type of instruction) influence sell-out. In no case are there neither real case studies/end-to-end solutions nor an operative definition of how an Innovative KPIs Measurement System should be designed and implemented and which benefits could come from it.

The objective of this work is studying how Digital Technologies could provide retailers opportunities for monitoring Innovative KPIs which follow the technological evolution path of the store and allow players to deepen the understanding of customers behavior and their interaction with the store.

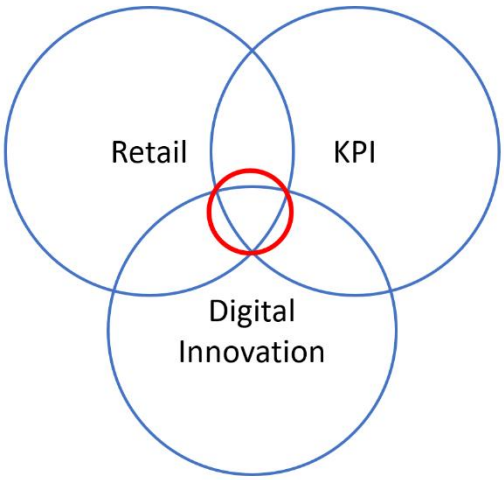


Figure 35. Gap Identified in the Intersection of the Three Areas of Investigation

3. Traditional KPIs

The objective of this work is studying how Digital Technologies enable the adoption of an Innovative Key Performance Indicator Measurement System in Retail. Therefore, it is important to develop a deep KPIs analysis to understand which are the most used by different players.

3.1 KPI development process

The right **identification** of KPIs is the first step in order to understand what needs to be measured and could improve the overall business performances.

The process to improve through definition of new KPIs is described in the following model.

Figure 36. Techtarget_2017 KPIs Development Process

The **Create** phase is the one following the KPIs' identification. Here the main challenge to face is to deliver this KPIs to business users who need to be informed about their value and that can eventually act on some parameters to conditionate the results. It may happen that KPIs that a manager or an employee needs to monitor are many and this dramatically increases the importance of a clear and well-defined dashboard, easy to read and that highlights what important. An additional difficulty could be the need of having real-time computed KPIs (or computed with a batch processing logic but with a highly narrow time interval).

The **Evaluation** phase consists in comparing the current results of the business with the target defined. If there are some misalignments, a further investigation is needed to understand the reasons behind them and identify room for maneuvers.

The next step is the **Change** one: in this phase, opportunities of applying corrective actions are deeply explored, to understand what the best option is the one to choose and pursue. If some trade-offs are present, benefits and costs of each are evaluated. There is the possibility that an action has a positive impact on the considered KPI but a negative one on the others and vice versa. Of course, also this is taken into account.

Once having decided the corrective/improving actions a company decided to follow, the **Asses** phase checks if the performances reflected by KPI's value are actually improved. So, have the defined target values been matched? If not, what is the reason behind? If yes, is there something that can be improved even more? Of course, business users must be aware of how their actions can influence the values of KPIs; for this reason, a good practice is to analyze the situation and define a sort of lesson learnt.

The model is not a stand-alone event, but rather a process that continuously updates since business changes and evolves and, consequently, also KPIs need to follow it.

3.2 Traditional KPIs Classification

Once identified the gap not discussed in the literature, to deepen the knowledge of the KPIs currently chosen by retailers and CPG companies to monitor their performance, in this work a further research has been carried out. In particular, a new framework has been developed in order to classify all the KPIs identified. To collect the KPIs, several online researches have been made, consulting general business sources, web articles and specialized websites (e.g. www.kpilibrary.com) as well. Further material has been provided by Osservatorio Innovazione Digitale nel Retail of Politecnico di Milano. Of course, only KPIs related to Retail industry have been collected and classified, while general KPIs in common among all different industries have not been considered.

The general information part of the framework defined is organized as following:

- KPI name

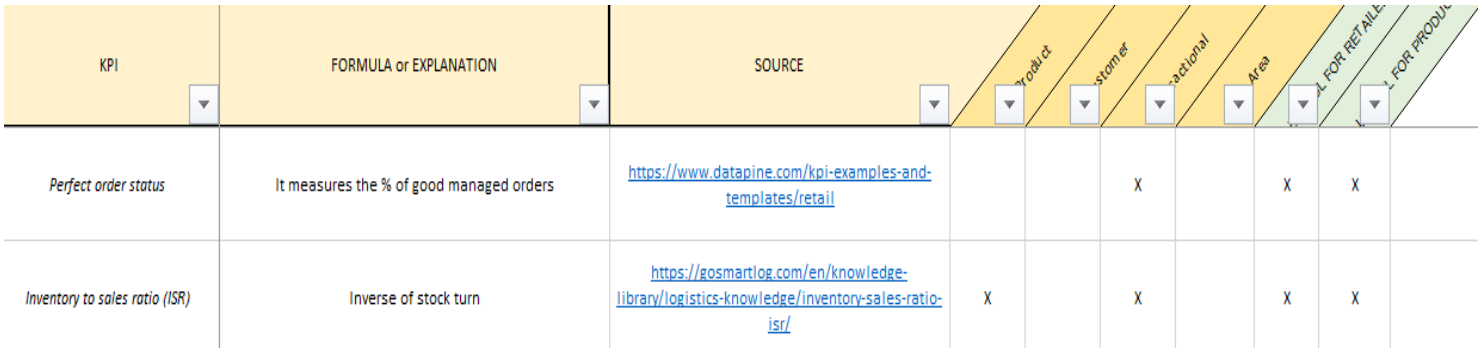
- KPI formula (or explanation)
- Source

Then, a classification concerning the field of the KPI refers to has been carried out. As already done in the framework defined to classify the documents of literature review, four types of KPIs have been identified:

- *Product*: KPIs of this type are useful to understand performance against target of a single or a category of products (e.g. level of satisfaction of a product or average batch purchased).
- *Transactional*: KPIs company can get data needed from transactions (e.g. sales of a specific product)
- *Customer*: KPIs providing information related to the behavior, the thoughts, the emotions of the customer (e.g. average time spent in the store)
- *Area*: KPIs of this type, provide evidences of characteristics/performance of what happens in a specific area of the store during the shopping or its performances (e.g. average level of queue in front of a shelf or max queue length)

To make sense, a KPI to be used to monitor something should be useful to at least an actor involved in the relationships, considering useful when it provides information concerning performance that can trigger corrective or improving action. Basically, the main actors involved are the Retailers (e.g. Esselunga) and the CPG (Consumer packaged goods) companies (e.g. Barilla). So, the last part of the framework defined focused on classifying these aspects.

Following a screenshot of the framework defined has been provided.



KPI	FORMULA or EXPLANATION	SOURCE	Product	Customer	Transactional	Area	L FOR RETAIL	L FOR PRODU
Perfect order status	It measures the % of good managed orders	https://www.datapine.com/kpi-examples-and-templates/retail			X		X	X
Inventory to sales ratio (ISR)	Inverse of stock turn	https://gosmartlog.com/en/knowledge-library/logistics-knowledge/inventory-sales-ratio-isr/	X		X		X	X

Figure 37. KPIs Classification Framework

This part of the work allows to identify what are the KPIs already chosen by players to monitor performance and to have them well organized aiming at understanding if there is room for the definition of new KPIs.

Following, the list of KPIs collected is presented, organized for each category (some KPIs belong to more than one category).

KPIs related to Products

KPI	FORMULA or EXPLANATION
Sales	Total revenues
AVG Batch dimension	#Units_Sold/#Purchasesincludingthatitem
Conversion rate	% of visitors taking a desired action
Stock turn	COGS/Avg Inventory
GMROI	Gross Profit/Avg Inventory
Sell Throught	(Number Of Unit Solds/ Beginning Inventory)*100
Inventory to sales ratio (ISR)	Inverse of stock turn
Product shelf-space profitability	It measures the profitability of a product compared to the space occupied on shelf
Coupon conversion %	It measures the effectiveness of a promotion
% of store assortment available also on website	It measures how online and in-store assortment are similar
Product share on shelf	It measures the percentage of space occupied by a product on the totality of shelf
Share of wallet	The expense of a customer related to purchase of a specific product in a product category
Share of voice	How many times the name of the company is mentioned compared to numbers of mentions of the category

Figure 38. KPIs related to Products with Formula or Explanation

KPIs related to Customer

KPI	FORMULA or EXPLANATION
AVG Number of items purchased	Total Number Of Items Purchased/Number Of Purchases
Time spent in the store	Number of minutes the customer spends in the store
Traffic	Number of customers visiting the store during a period of time
Customer retention	((CE-CN)/CS)*100
Frequency of store visits	Number of times a customer visits the store in a defined timeframe
Coupon conversion %	It measures the effectiveness of a promotion
Share of wallet	The expense of a customer related to purchase of a specific product in a product category
Repeat buyers	Ratio of fidelized buyers compared to total number of buyers

Figure 39. KPIs related to Customers with Formula or Explanation

KPIs of Transactional type

KPI	FORMULA or EXPLANATION
Sales per employee	Net Sales/Number Of Employees
Sales	Total revenues
AVG Batch dimension	#Units_Sold/#Purchasesincludingthatitem
AVG Number of items purchased	Total Number Of Items Purchased/Number Of Purchases
Sales per square foot	Net Sales /Amount of Sales Space
Conversion rate	% of visitors taking a desired action
Gross profit	Sales Revenues - COGS
Net profit	All Revenues - All Expenses
AVG transaction value	Total Revenues/#Transactions
Stock turn	COGS/Avg Inventory
GMROI	Gross Profit/Avg Inventory
Sell Throught	(Number Of Unit Solds/ Beginning Inventory)*100
Back order rate	Amount of orders that cannot be fulfilled at the moment the customer places an order, divided by the total number of orders
Rate of return	Number of Order Returned/Total Order
Order status	Overiview of the status of current orders
Perfect order status	It measures the % of good managed orders
Inventory to sales ratio (ISR)	Inverse of stock turn
AVG shelf space cost	It measures how a unit of shelf space costs
AVG shelf space profit	It measures the profitability of a shelf space unit
Coupon conversion %	It measures the effectiveness of a promotion
Sales per selling hour	It measures the sales level per hour
% of revenues per brand	% of revenues generated by products of the same brand
Product category on total sales	% of sales of a category on total revenues
Shopping cart abandoned rate	% of customers who do not end shopping
Repeat buyers	Ratio of fidelized buyers compared to total number of buyers

Figure 40. KPIs computed on the basis of transactional data with Formula or Explanation

KPIs related to Area

KPI	FORMULA or EXPLANATION
Sales per square foot	Net Sales/Amount of Sales Space
Traffic	Number of customers visiting the store during a period of time
AVG number of employees per store	It measures the avg number of people working in a store
Product share on shelf	It measures the percentage of space occupied by a product on the totality of shelf

Figure 41. KPIs related to Area with Formula or Explanation

3.3 KPIs Analysis

Firstly, 50 KPIs related to Retail Industry have been collected and, later, 14 of them have been discarded in order to avoid redundancy of information. 36 of them have been kept and classified through the framework just defined.

The KPIs labelled as traditional are the ones already in use that do not stem from the adoption of Digital Technologies (e.g. that do not exploit data gathered by IoT devices or other tools).

The results of classification in categories of traditional KPIs is shown in the following graph.

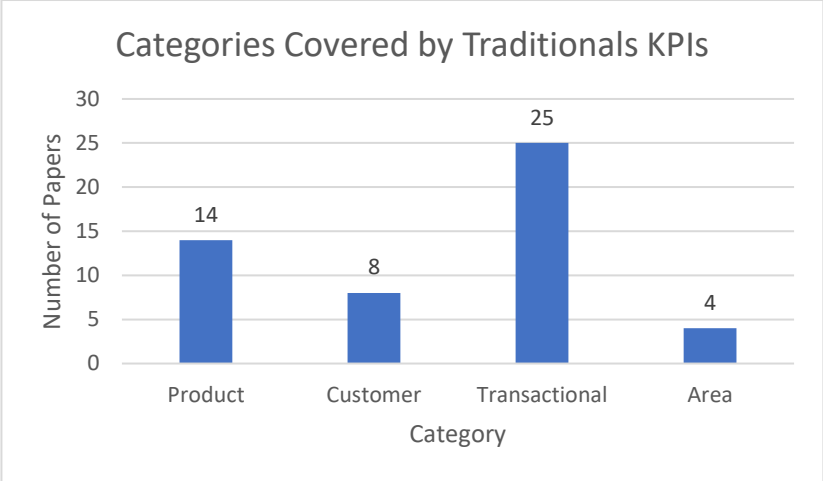


Figure 42. Categories Covered by Traditional KPIs. Numbers refer to how many KPIs cover each category.

The most of KPIs as one can intuitively understand belong to transactional category. The data needed to compute them are supposed to be the easiest to gather since they stem from transactions (e.g. sales) that are already registered by players for a long time.

The sum of the counts of each column of the last histogram is higher than 36; this is basically since some KPIs have been classified as belonging to more than a category, as shown in the graph below.

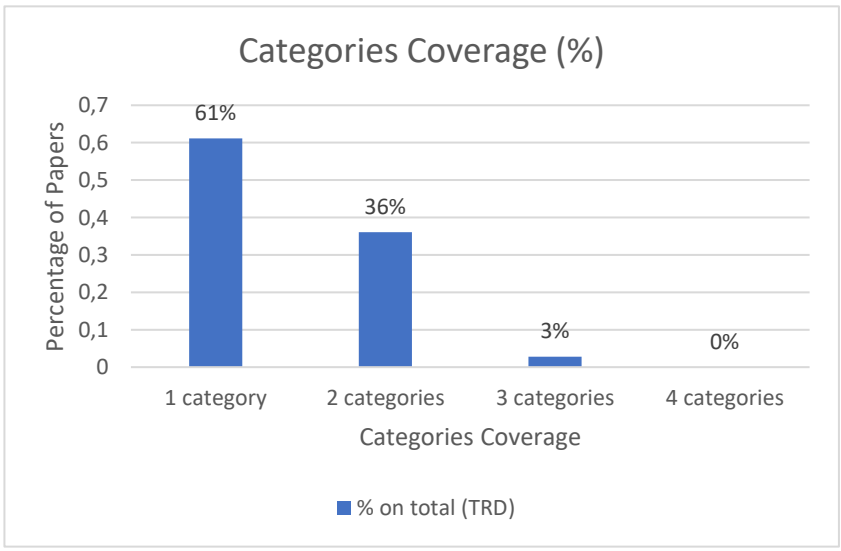


Figure 43. KPIs Categories Coverage. The percentages refer to % of KPIs covering 1,2,3 or 4 categories

An understanding of the type of players that could adopt KPIs selected has been carried out. Results are shown in the following graph: retailers useful only KPIs are the 58%, 6% represents the KPIs which are useful for CPG companies, while the 36% of KPIs can be adopted by both the types of players.

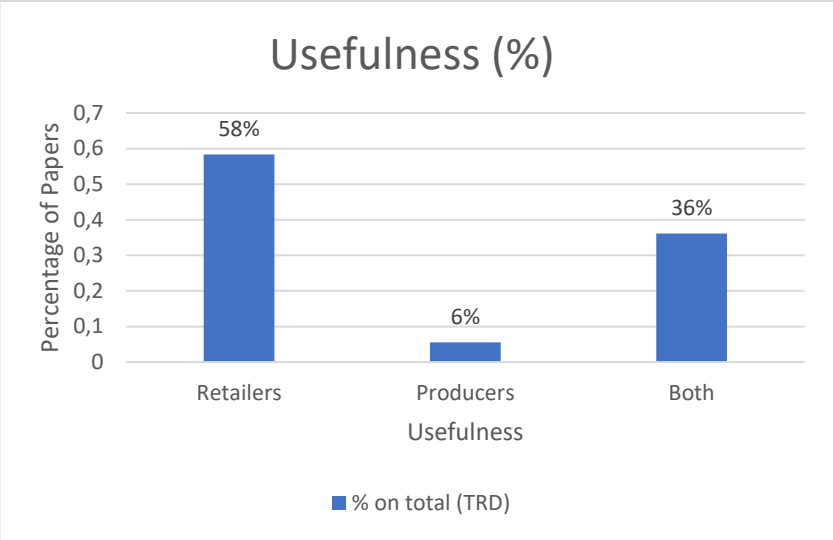


Figure 44. Usefulness. Percentages refer to % of KPIs classified as useful for each type of player or both

Summing up, the majority of KPIs already in use rely on data stemming from transactions. Moreover, since transactional data are registered mostly at the in-store check-out, there is no knowledge about what happens during the previous phases of the shopping process.

So, currently there is no evidence of the adoption of KPIs exploiting data collected from digital sources and monitoring aspects different from transactional ones. Sensors and IoT are in general gaining lot of momentum and are the tool to exploit new opportunities stemming from the data that before was not possible to collect. Sensors are becoming today smaller and smaller, cheaper and the connection allowing them to transfer data collected has improved; so today their adoption seems to be ready to start by a technological point of view. Also, the most important companies' systems providers (e.g. SAP, Salesforce) have spotted the necessity of integrating the new technologies in their products, aiming at offering to customers solution as much effective and efficient as possible to run their business.

This section has answered to the initial research question "*Which are the current KPIs retailers and CPG companies monitor during the end-to-end shopping process?".*

4. Store evolution overview

4.1 Introduction

After having analyzed how both the scientific and the non-scientific literature have discussed the three research topics and once having identified the gap, an overview of Retail context is needed.

The objective of this chapter is to spot which the most implemented digital innovations are, understanding which opportunities stem from their adoption and how they are evolving the store. This research relies on the collaboration with Osservatorio Innovazione Digitale nel Retail of Politecnico di Milano , analyzing 80 among 300 top retailers in Italy for revenues and studying 100 projects of store transformation.

4.2 Italian Retail Context

In the last years, eCommerce and new ways to interact and purchase have changed the way customer perceive the store and the reasons behind visiting it. eCommerce is still today the second shopping channel for sales, but it is growing at expenses of the traditional physical channel.

Store is conceived no more as the only channel where buying products is possible, but players aim at finding new meanings and functionalities, towards the building of a relation with customers. To do this, several investments in Digital Technologies are needed, in order to catch new opportunities.

Today top Italian retailers' digital investments resulted to be quite low. In particular, between 2017 and 2018, they increased of just one percentage point, from 20% to 21% of the total revenues. These values reflect the fact that Italy, if compared to other foreign countries, can be considered late concerning the Innovation pace.

Regarding macro-processes, in 2018, the interest of industry in the Digital Innovations, towards the enhancement of customer experience in store, increased. Nevertheless, back-end innovations resulted on average the more adopted. More innovative front-end technologies as Digital Kiosk, totems, salesforce automation and online selling system have been tested on a limited number of shops, without being scaled on the entire network.

In 2018, considering 80 of 300 top Italian retailers, the digital investments were diversified as following:

- 33% of the sample invested on innovative payments solution (e.g. Bricofer Italia, Leroy Merlin)
- 27% of the sample invested on electronic billing solution (e.g. Bennet, Gruppo Pam)
- 24% of the sample invested on CRM solution (e.g. Crai, Moncler)
- 24% of the sample invested on mobile PoS solutions (e.g. Benetton Group, Decathlon Italia)
- 22% of the sample invested on sales force automation solution (e.g. Coop Alleanza 3.0, Expert Italy)
- 22% of the sample invested on Wifi in-store solution (e.g. Thun, Loro Piana)
- 21% of the sample invested on couponing and digital loyalty solution (e.g. McDonald's Italia, Penny Market)
- 19% of the sample invested on in-store customer monitoring solution (e.g. Carrefour Italia, Miroglio Group)
- 19% of the sample invested on BI analytics (e.g. D.IT Distribuzione Italiana, Coop Liguria)
- 16% on digital signage and Intelligent shop windows (e.g. Esselunga, KIKO Milano)

Wrapping up, it is possible to identify four main digital technologies usage directions, two for back-end (1-2) and two for front-end (3-4):

1. Improving processes efficiency through the reduction of costs and the improvement of quality
2. Fostering the data driven orientation with a particular emphasis of the creation of a unique view of the customers
3. Making the access to product and its purchase as easy as possible
4. Reducing no value-adding activities duration

Although some progresses have been achieved, still there is a gap between theorical aspects and practical ones. Among the factors determining this situation, there is a lack of a clear strategic view of innovation, the presence of a top management not embracing changing opportunities, difficulties in developing or acquiring digital competences and business roles.

Concerning 300 top SME retailers surveyed, it has been assessed that the incidence of digital investment resulted quite limited, equal to just few % points of revenues. Uncertain economic returns, lack of internal competences, low level of awareness and knowledge of available market solutions are the main barriers that prevent an increasing in investments.

Below the bar chart reporting digital investment priorities.

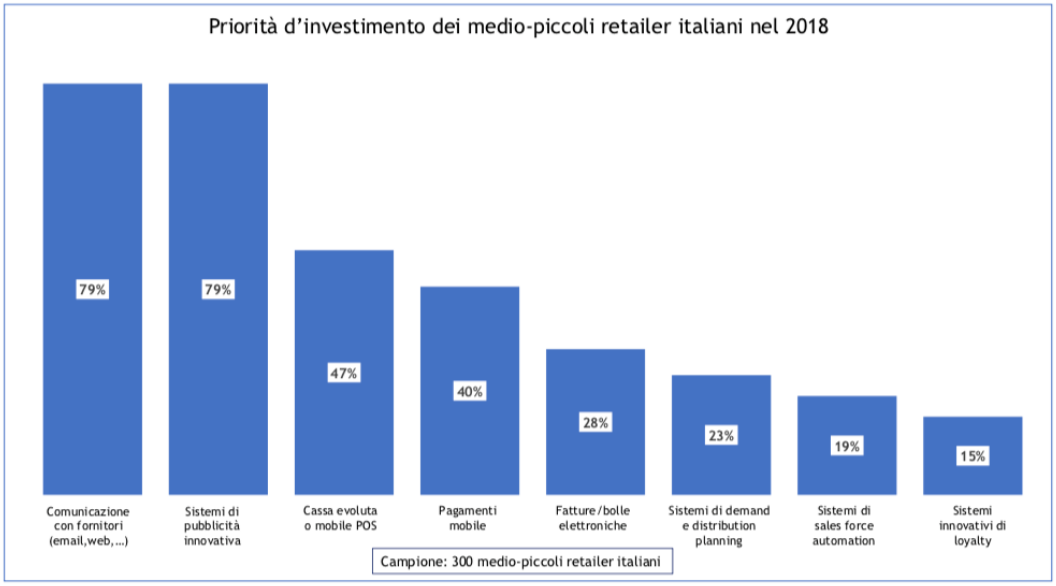


Figure 45. Figure 36. SME Retailers Investment Priorities

It is possible to notice that there is a difference between SME retailers and top ones concerning investments priorities. While top retailers are more interested in generating knowledge about their customers and how shop processes perform, SME retailers prioritize supplier communication solutions and advertising initiatives; these last practices are already well-consolidated and optimize in big retailers' environment.

4.3 Conclusion

To conclude, given the opportunities by the adoption of Digital Technologies, the shop transformed itself and its span of action: firstly, building a relation with customer thanks to data collected is now possible; secondly, the store is integrated with other touchpoints in order to create a unique view of the customer. So, Digital Technologies became the enabler of the evolution of the physical store, from a transactional place where focus is centered on product, to a more complex one, where the focus follows a relational logic and, consequently, customer-oriented.

Data are what provide the possibility to know the customer, its behavior, its preferences. They do allow the understanding of how store is performing as well. The next step of this research will focus on which Digital Technologies players today can leverage on in order to deepen the just mentioned aspects. This means investigating Digital Technologies which are gaining momentum in the Retail Industry, proving opportunities for improving customer and store performances knowledge.

This chapter has answered to the question "*How Digital Technologies enhance the store evolution in Italy?"*

5. Technologies Analysis

5.1 Introduction

Once assessed the current KPIs adopted by Retail Industry players, the focus shifted on the study of Digital Technologies that are gaining momentum in Retail. During the internship carried out in Accenture, it has been possible to get in touch with different areas of the company; it has been spotted in ACIN – Accenture Customer Innovation Network (following presented), the possibility to pursue the research objectives. ACIN is an environment highly closer to customers for co-developing new innovative scenarios, and where real-cases are studied. In addition, it is a place where knowledge regarding the hottest technologies transforming industries is created.

5.2 Accenture Customer Innovation Network Milan Overview

In Milan, the ACIN is structured with different rooms, some of theme dedicated to a specific industry and others used for meetings, events and workshops.

Figure 46. ACIN Milan Map

The main representative and characteristics rooms are the Smart Grocery, the Digital Bar, the Smart Home and Boutique.

Here below an image of the rooms and briefly, the business ideas behind them:

1. Smart Grocery

Figure 47. The Smart Grocery

"New store formats, meal kits, prepared food and fresh are some of the trends in grocery today. Grocers are determining how to capitalize on technology and continuously innovate –a complex problem. Retailers need to collect large amounts of data on customer behavior (such as interactions with the digital shelf) as well as store operations (e.g. smart equipment that provides various energy management dashboards). For consumers, it is also important to live a personalized experience. Retailers can enable this through facial recognition, synchronization of the shopping list and route optimization with a 'smart cart'. An AI-powered recommendation engine provides suggestions of items based on habits, recipes, tips and promotions

.

2. Digital Bar

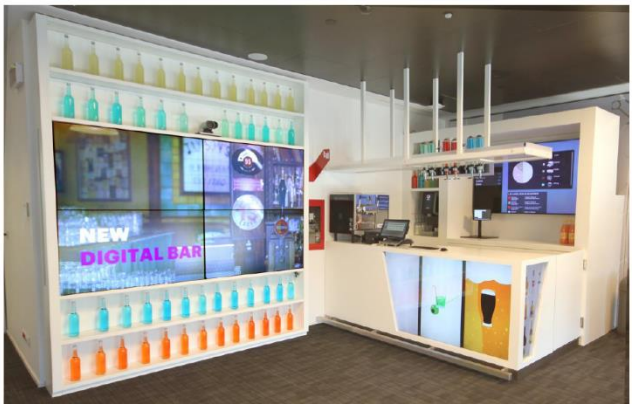


Figure 48. The Digital Bar

"Consumers value experience like never before. Consumer Goods companies create moments that matter by meeting their consumer in their world, leveraging digital touchpoints across the journey".

Digital Bar Highlights:

•Connected equipment of the Digital Bar relies on IoT models, real time monitoring, machine learning and predictive analytics that evolve ways of working for different stakeholders, guaranteeing quality and performance at Point of Sales.

•Geo-marketing Social Media Analysis allows Consumer Goods companies to identify the trendiest Point of Sales in a reference area.

•In-store digital interaction encourages the in-bar flow of consumers through an improved and personalized experience, involving engagement and cultivating consumer loyalty.

3. Smart Home

Figure 49. The Smart Home

"High-tech features are slowly making the connected home provide an extraordinary insight into the journey of the increasingly higher consumer expectations moving from personalized products to living services. This space is designed with the intention to celebrate and showcase emerging trends inside home, the place where CPG companies can get in contact with final consumer and where consumer's needs arise".

Thanks to the Digital Voice Assistant (DVA) We bring to life omnichannel experiences, i.e.:

•Connected fridge: the suggestion engine is activated by the DVA that match the ingredients in the fridge. There is also the possibility to order directly from the fridge, creating a new platform.

•Prototype of a connected dispenser: washing machine checks in real time the level of detergent. This scenario introduces new types of business models (i.e. subscription and delivery service) to answer to the challenges of the market

4. Smart Boutique

Figure 50. The Smart Boutique

"The global fashion industry is moving into a decisive phase following digital adoption by mainstream consumers. But emotions and creativity remain at the heart, and it means that technology will not totally shake the traditional customer experience and the physical store will still play an important role in connections with customers.
In order to stay relevant, the store needs to find its true purpose. This means being able to offer a unique and personalized experience designed according to demographics and style, where products can be customized, there is still a physical "touch and feel" aspect, and human relationships are preserved with sales assistants using recommendation engines. The overall experience creates a cycle that improves customer satisfaction and enhances data collection, a valuable tool to make better decisions both at store and enterprise level".

As this research focuses on the Retail world, the study could have been focused on both the Smart Grocery and the Smart Boutique; since the Smart Grocery was richer than the Boutique in term of available installed technologies, the research proceeded focusing only on the former.

5.3 ACIN Grocery technologies

Inside Grocery, different technologies are available:

1. An interactive shopping cart equipped with a barcode reader and an iPad with an artificial Intelligence software inside. Using a QR code, a customer can connect his smartphone to the cart, enabling it to read the shopping list previously created and saved on the smartphone. Through a system of beacons, on the iPad different information related to the shopping list are displayed as well as recommendation or promotion according to where the cart is placed inside the Grocery. After scanning the product barcode, the AI software analyses if it is coherent with what is inside the shopping list or not. Leveraging on these data gathered, the software creates aggregated statistics.

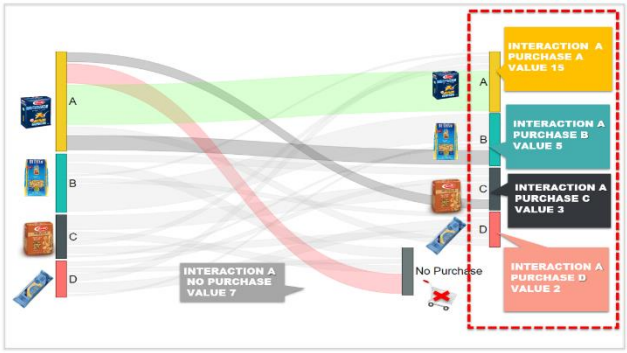


Figure 51. Grocery Demo 1

2. A software able to monitor prearranged Grocery zone (e.g. the areas close to a specific shelf). Thanks to a cam positioned on the ceiling, the software evaluates customers traffic inside those areas.

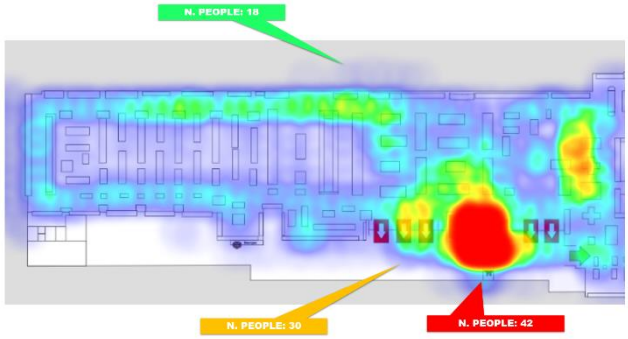


Figure 52. Grocery Demo 2

3. A software which, thanks to a camera positioned in front of one or more shelf, is able to understand the current level of products stock and to send a notification as soon as the number of units of a specific product goes under a specific

threshold. This software can recognize exactly every different product because is based on a planogram; as long as the products displaying changes, it would be enough to change the planogram.

4. A software which through a cam positioned on the self (looking customers)

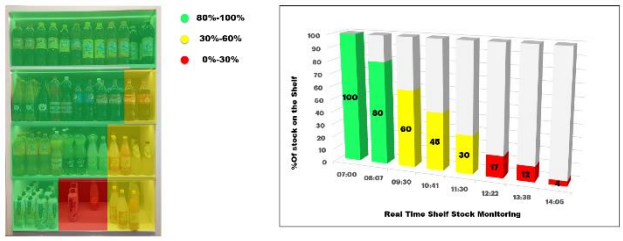


Figure 53. Grocery Demo 3

analyses ethnographic and mood customers' characteristics, providing data about gender, age, beard, mustaches, glasses, mood, time spent in front of shelf paying and without paying attention.

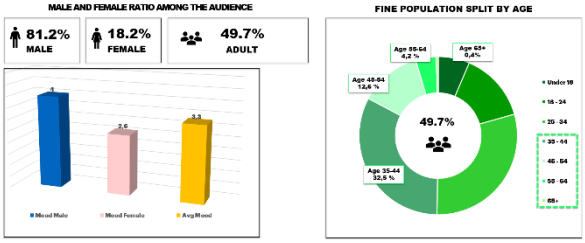


Figure 54. Grocery Demo 4

5. A laser technology able to assess a customer path inside a detection area, his exact position (in a timestamp), some customer info (e.g. the height), his status (appear, walk, standhand, crunch, disappear), the coordinates of the product taken from the shelf and with which hand (right, left).

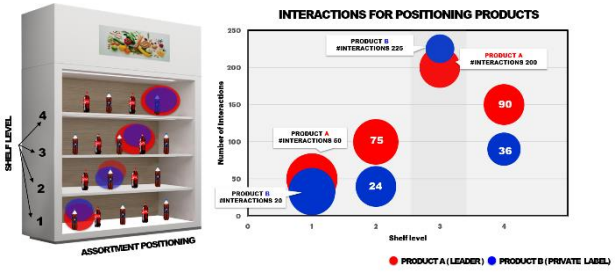


Figure 55. Grocery Demo 5

6. A Digital Display which change content delivered to customers according their profile. After staying some seconds in front of it, the tool displays the appropriate message to enhance sales. For example, if a bearded man stands in front of it, beard specific products are displayed. While, if there is a child, the tool displays sweets.

Figure 56. Smart Grocery Digital Display

7. An interacting display suggesting through lights the most appropriate wine according to customer general preferences collected through different questions proposed by the tool. Questions concern different variables such as budget range of the customer, menu the wine has to be associated with, general preferences of type of wine (white, red, rosé).

Figure 57. Wine Recomandation Engine

Most of the technologies described represent data sources players could leverage on in order to develop knowledge on customer behavior, preferences, profiles and get awareness of what happens during in-store shopping process.

These paragraphs answer to the research question "*Which are the today-available Digital Technologies allowing the collection of data on customers inside the store?"* with a detailed analysis of the technologies available in Smart Grocery.

The next research section focuses on how these Digital Technologies could be exploited to design Innovative KPIs providing new opportunities to know the customers.

6. Innovative KPIs

6.1 Introduction

Once assessed what are the traditional KPIs and having explored what are the new technologies gaining momentum in the Retail Industry thanks to the research made in ACIN and in particular in Smart Grocery, the research work moved onto the design of Innovative KPIs enabled by Digital Technologies. They allow industry players to shift the perception they have of the in-store shopping process from a black box, where it is quite difficult to generate valuable insights, to a measurable and understandable process.

6.2 KPIs designing

Thanks to all the information acquired shown in the previous sections of the research, the material provided by Osservatorio Innovazione Digitale nel Retail of Politecnico di Milano and the possibility of interacting with Retail Industry experts in ACIN, it has been possible to proceed with the definition and design of new KPIs.

16 innovative KPIs have been designed; following each of them is explained, considering also possible improving/corrective actions deriving from their monitoring.

AVG_time in front of shelf

It measures the average time that a client spends near a specified shelf.

Possible corrective/improving actions

Suppose the data gathered reveal that customer spend in general 5 minutes in front a shelf (that could be a higher time interval). This could mean that the customer is not finding what she/he is looking for; in this case a possible solution could be redefining the products displaying of the shelf. Or maybe the so long time spent in front of shelf means that there is high incertitude regarding two or more products; the retailer could act on display, prices to facilitate the choice of the product with the higher margin to sell more profitable products over low profitable ones. Another case could be that the

price of the products the customer wants is too high, and she/he is thinking about buying it or not; here retailer or CPG company could redefine the price.

$$TimeInFrontOfShelf_{avg}[s/client] = \frac{\sum time\ in\ front\ of\ shelf\ of\ each\ customer}{\#customers\ registered}$$

Attention rate

Thanks to data gathered, it is possible to know the total time spent by a client in front of shelf and the time spent in front of shelf paying attention. This last over the first gives the ratio of attention of each client.

Possible corrective/improving actions

Being aware of how long customers stay near the shelf paying attention to it allows to understand how impactful the packaging of a product exposed should be. In fact, for example knowing that customers do pay very low level of attention companies has to ideate something cool has to capture their interest. The same reasoning could be applied in case of displays installed on the shelf showing advertising: the content delivered should be chosen based on the level of attention of clients (very impactful for low attentive type of customers to capture them while the duration could be longer in case of type of customers with higher attention level in front of shelf).

$$AttentionRate[\%] = \frac{\sum attention\ time\ of\ customers}{\sum time\ of\ exposure} * 100$$

Interaction rate

This KPI is defined as the ratio between the number of customers interacting with a product exposed on the shelf and the number of watchers (people paying attention at least a moment to the shelf). It basically can be conceived as a conversion rate showing how a product performs on shelf.

Possible corrective/improving actions

Suppose data reflect that there are many customers that pick up the product from the shelf and then they put it back on the shelf. This could highlight that the product has an attractive packaging but maybe the price is too high, so the customer does not want to proceed with the purchase. Or another case could be the one in which the customer picks up a food product but reads that there is an ingredient that is not healthy. So, in the first case the corrective action could be working on price, in the second one could exploit the information that customers do not like the present of a specific ingredient to redefine the recipe.

$$Interaction\ Rate[\%] = \frac{\#customers\_interacting}{\#watchers} * 100$$

Appealing ratio

It is the ratio of the number of interaction of customers with a product over the ones with a category. This information provides something like the ratio of sales of a product over the sales of a whole category but has a focus on the interaction process. So, it has not been considered as transactional but only as product related.

Possible corrective/improving actions

If comparing this value with the one of sales if there are mismatches: considering just the sales could be misleading since does not reflect the behaviour of customers in front of shelf. For example, a product could be picked up many times and then a similar product is preferred to go on with the purchase. This maybe reflects that the packaging is attracting but the product is not so valuable, so the customers end picking it back. An improving action could be signal this phenomenon to R&D in order to understand what the problem with the product is.

$$AppealingRatio_{productX}[\%] = \frac{\#interactionwithproductX}{\#interactionwithcategory} * 100$$

Target coherence

Considering the total number of interactions with a product, this KPIs is the measure of how much of them are carried out by customers with a profile "in target".

Possible corrective/improving actions

Let's think about a product whose target is made by males and females around 30 years old. If the most people interacting at shelf with this product is made by very old person profile, maybe the product or the brand is not perceived as young. So, the advertising should be redirected to get the attention of the customers with a profile aligned with the one supposed to be. Delivering young contents and working on brand perception to make it "younger" could enhance sales.

$$TargetCoherence[\%] = \frac{\#interactions\_in\_target}{\#interactions} * 100$$

Interaction mood ratio

This KPI reflects how customers interacting with a specific product are feeling. Is the customer happy when the customer picks up the product? Is she/he neutral? Is the customer sad?

Possible corrective/improving actions

Suppose the customers interacting with a specific product do feel sad. What does it mean? It could be a product generally bought when experiencing a sad moment (e.g. chocolate) and so there is no extreme need of correct something or, on the other side, this could reflect a such not high satisfaction of customers and, in this case, further investigation to identify the problem has to be carried out.

$$InteractionMoodRatio[abs] = \frac{\sum avg\_mood\ interacting\ customers}{\#interacting\ customers}$$

This KPI range is [0,1]

Please notice that the sum of mood of interacting customer is possible thanks to the fact that it is represented by a numerical value.

Watchers mood ratio

It is basically structured as the previous one with the difference that here the data chosen to compute it. Indeed, the data used are the ones still related to mood by the instances considered are not the ones with interaction but the ones with at least a moment of attention in front at shelf watchers.

Possible corrective/improving actions

Maybe a negative mood by the customer is given by the fact that there is disorder in product displaying of shelf. To this problem a possible solution could be the redefinition of the planogram related to the shelf considered

$$WatchersMoodRatio[abs] = \frac{\sum avg\_mood\ watchers}{\#watchers}$$

This KPI range is [0,1]

Please notice that the sum of mood of watchers is possible thanks to the fact that it is represented by a numerical value.

Opportunity ratio

This KPI is computed making the count of watchers (people that pass in front of the shelf and pay at least a moment of attention) and the Opportunity to see (people that pass in front of the shelf without paying attention). This information is quite important since provides an idea of what are the product seen by the customers and what are the parts of the store totally not considered by customers.

Possible corrective/improving actions

Suppose that the computation of this KPI reveals that a too small number of clients moving through the store pay attention to the shelf. Of course, if customer do not see the products exposed, it is quite difficult to think that they will buy those products. So, to enhance sales of products on a shelf, the retailer has to make the clients no more indifferent. To do this, a display can be introduced, a panel or something in general that capture the attention of the customers inside the store.

$$OpportunityRatio[\%] = \frac{\#watchers}{\#opportunitytosee} * 100$$

This KPI range is not computed real-time but it refers to a specific time interval

Real time marketing conversion rate

This KPI is supposed to be monitored as tool when there are advertising activities in the store. For example, shelves equipped with displays showing specific contents. Do these contents convert into a product picking?

Possible corrective/improving actions

Understanding the performance of contents delivered in display allows to correct them until the target objective is achieved. A corrective/improving action could be studying new content to deliver of digital displays or deliver the same content but work on colors, graphics and aesthetics in generals.

$$RealTimeMarketingConversionRate[\frac{units}{s}] = \frac{\#pickings}{\sum secondsofcontentdisplaying}$$

Area traffic ratio

This KPI provides information regarding the traffic in a specific area of the store. It basically reflects the concentration of people inside a store related to specific areas. It is about space management and finding the best way to exploit it.

Possible corrective/improving actions

Let's suppose, for example, that an area with high margin products is not seen by the customers entered the store maybe because it is a remote area of it. This is a problem because customers do not come to a zone in which they can purchase and increase profits of retailers and CPG companies. So, there is the need of making that area interesting for customers, for example inserting a totem or using sales people to earn customers.

$$AreaTrafficRatio_{specificarea}[\%] = \frac{\#peopleinanarea}{maximum_{number_{of\,people}}} * 100$$

Repositioning rate

This KPI provide information of how many times a product is picked up and it is put back on the shelf by the customers. The higher the value, the higher the product is appealing enough to be picked up but at the end there is something that does not convince the customer to make the purchase.

Possible corrective/improving actions

If customer quite often pick up product and put it back could mean that the packaging is appealing and attractive but there is something wrong. If considering food products, a bad ingredient in the recipe could be the reason behind this customer behaviour. Or again there is the possibility to have a price problem, that is too high, so customers prefer to change their mind and buy a similar product with a lower price.

$$RepositiongRate[\%] = \frac{\#re - positionings}{\#interactions} * 100$$

Watch product time ratio

This KPI is defined as the percentage of time spent watching the entire shelf related to observation of a specific product (e.g. If a customer watches the shelf for a minute and watch the item X for 20 seconds, the watch product time related to X is 33,33%). The data needed to compute this KPI are given by technologies of eye-tracking (not to bias the customer in front of shelf of course it should be well integrated with the shelf).

Possible corrective/improving actions

Suppose that the KPI has a very low value. This means that the product has not been noticed by the customer. So, there may be a problem in the packaging (and in this case it could be redesigned) or on the shelf display. In this last case, the sales representative of the CPG company of the product could negotiate a better position in the shelf.

$$WatchProductTimeRatio[\%] = \frac{Seconds_{watching_{the_{product}}}}{Seconds_{watching_{the_{shelf}}}} * 100$$

Planogram stock compliancy

Specific tool software based are designed to identify stock-out product at shelf. Those are cams projected toward the shelf that send different levels of alert according to the quantity of SKUs exposed. Accenture estimated that the missed revenues for stockout products at shelf is around 9%, so very high. This KPI measures how many products are at stockout considering a chosen shelf. Of course, the lowest this value is, the better the store is performing.

Possible corrective/improving actions

The higher the value, the higher the need of dedicate resources to repristinate the stock levels of SKUs exposed in the shelf monitored.

$$PlanogramStockCompliancy[\%] = \frac{\#stockoutproducts}{\#productsexposedonshelf} * 100$$

Planogram prices compliancy

Specific tools similar to the one described in the previous KPI are able to identify wrong prices exposed on a shelf (e.g. planogram tool for Cloud 4 Customer of SAP Sales Cloud).

This could create bad situation with customers at the checkout. In general, this kind of tools still require human intervention, since prices are more difficult to identify for a cam compared to stock units but provide a relevant help. So, it is a task that has to be performed by a sales person.

Possible corrective/improving actions

As soon as a price problem is detected, convert the price into the right one.

$$PlanogramPricesCompliancy[\%] = \frac{\#productswithwrongprice}{\#productsexposedonshelf} * 100$$

Average checkout time

This KPI considers the time needed for a customer to pay and exit from the store. It must be as low as possible, because this phase is necessary but no value adding at all for the customer. The data needed to compute avg checkout time could be registered by a tool that registers appearing time of each person and the time of disappearing.

Possible corrective/improving actions

After having set a target for this KPI, compare the result obtained with the target, in order to spot misalignment. If the target is not matched, study different solution for fast checkout (carry out simulations with different queue systems, new checkout possibilities as paying from the smartphone, self-checkout…)

$$AVG_{checkout_{time}}[s] = time\ needed\ to\ pay\ and\ exit\ the\ store$$

Time before interaction

It represents the time needed for a client before doing an interaction with a product exposed at shelf. This could provide insight regarding how the customer is behaving. For

example: does she/he spend so much time because of a bad displaying? What is the reason behind this? Are there too many similar products?

Possible corrective/improving actions

KPI could reveal that the people passing in front of shelf spent too much time watching it. The reason behind this is that there are too many products with similar characteristics and price. To avoid the customer choosing a competitors' product, a possible action could be working on packaging in order to make it more attractive and drive the choice of the customer toward that product. Or, on the other side, convince him thanks to price manoeuvres: lower price to let him perceive he is making a good deal, higher to enhance his quality perception regarding the product.

$$TimeBeforeInteraction[\frac{s}{client}] = \frac{time\ spent\ by\ a\ customer\ before\ interacting}{\#interactingcustomers}$$

Please notice that only customer interacting with shelf are considered for the computation of this KPI.

6.3 Innovative KPIs Classification

The just presented 16 KPIs have been classified according to the same framework defined before and it is reported in the following screenshots.

KPI	FORMULA or EXPLANATION	SOURCE	Product	Customer	Interactional	Area	L FOR RETAILE	L FOR PRODU
Attention rate	TOTAL ATTENTION TIME/TOTAL DWELL TIME	OUR DEFINITION		X		X	X	
AVG_TIME in front of SHELF	TOTAL DWELL TIME/ WATCHERS	OUR DEFINITION		X		X	X	
INTERACTION RATE	NUMBER OF INTERACTING CUSTOMERS/WATCHERS	OUR DEFINITION	X	X				X
APPEALING RATIO	INTERACTION WITH PRODUCT/ INTERACTION WITH CATEGORY	OUR DEFINITION	X					X
TARGET COHERENCE	NUMBER OF TARGET INTERACTIONS/#INTERACTIONS	OUR DEFINITION	X	X				X

Figure 58. Innovative KPIs Part 1

KPI	FORMULA or EXPLANATION	SOURCE	Product	Customer	Transactional	Area	FOR RETAILER	FOR PRODUCER
INTERACTIONS MOOD RATIO	AVG MOOD OF CUSTOMERS INTERACTING WITH SHELF	OUR DEFINITION	X	X		X	X	X
WATCHERS MOOD RATIO	AVG MOOD OF CUSTOMERS IN FRONT OF SHELF	OUR DEFINITION		X		X	X	
OPPORTUNITY RATIO	WATCHERS/OPPORTUNITYTOSEE (OTS)	OUR DEFINITION		X		X	X	
AREA TRAFFIC RATIO	OTS_AREA (t)/TOTAL IN STORE CUSTOMERS(t)	OUR DEFINITION				X	X	
REPOSITIONING RATE	It measures the % a product that has been picked up is repositioned back on the shelf	OUR DEFINITION	X				X	X

Figure 60. Innovative KPIs Part 2

KPI	FORMULA or EXPLANATION	SOURCE	Product	Customer	Transactional	Area	FOR RETAILER	FOR PRODUCER
WATCH PRODUCT TIME	Time spent by a customer watching a specific item compared to time spent watching the entire shelf	OUR DEFINITION	X	X		X	X	X
REAL TIME MARKETING CONVERSION RATE	It measures the effectiveness of real time interactions with customers during shopping	OUR DEFINITION	X	X	X		X	X
PLANOGRAM STOCK COMPLIANCY	NUMBER OF STOCK-OUT PRODUCTS/NUMBER OF EXPOSED PRODUCTS	OUR DEFINITION	X					X
PLANOGRAM PRICE COMPLIANCY	NUMBER OF CORRECT PRICES/ NUMBER OF PRODUCTS EXPOSED	OUR DEFINITION	X					X
AVG CHECKOUT TIME	AVG time spent by a customer to pay and exit the store	OUR DEFINITION		X			X	
TIME BEFORE INTERACTION	Seconds elapsed before interacting with shelf	OUR DEFINITION	X	X			X	X

Figure 59. Innovative KPIs Part 3

6.4 Innovative KPIs Analysis

Since Innovative KPIs stem from the gathering of data registered by different sources if compared with the ones of traditional KPIs, it is reasonable to expect a different distribution of topic coverage among Product, Customer, Transactional, Area.

In the following graph this aspect is shown and confirmed.

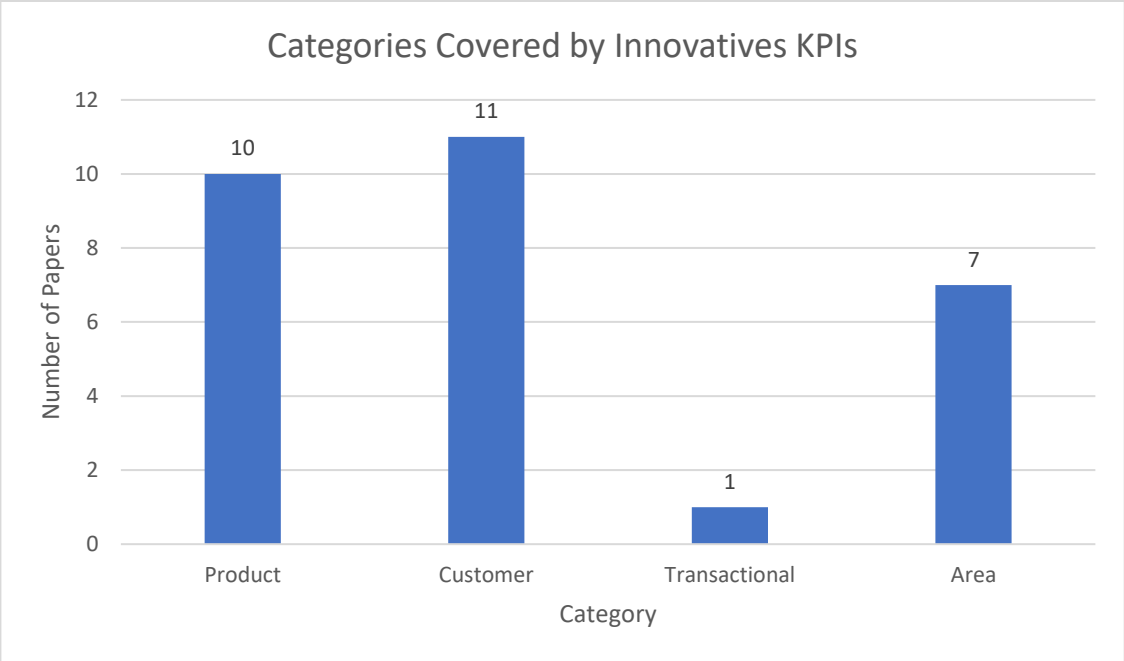


Figure 61. Categories Covered by Innovative KPIs. Numbers refer to how many KPIs cover each category

As specified for the traditional KPIs, the sum of the values of the columns is higher than the total number of KPIs. This because some KPIs have been classified as covering more than one topic.

Then, as done for the traditional KPIs section, the number of topics covered by the KPIs has been analyzed as well.

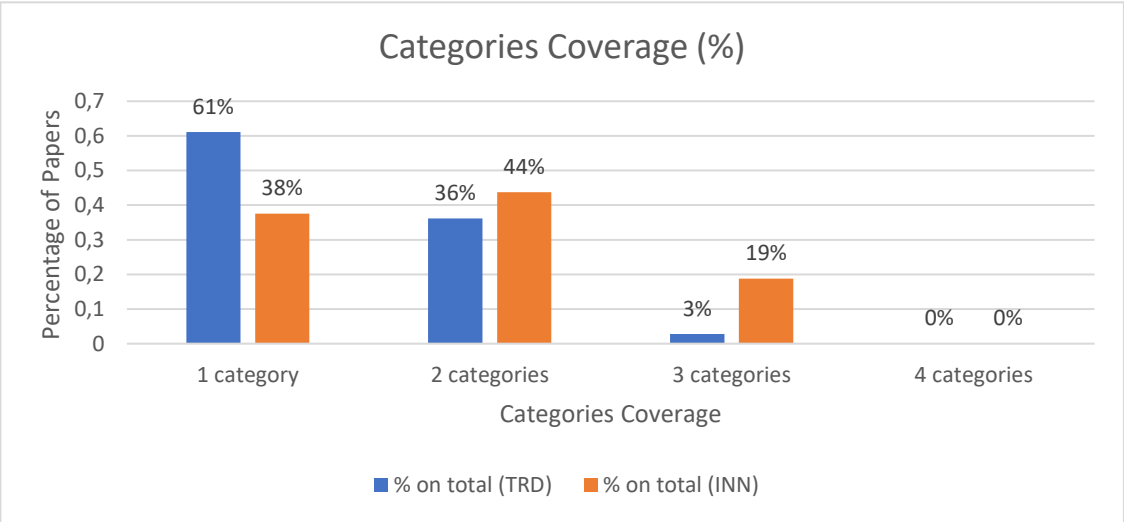


Figure 62. Figure 39. KPIs Categories Coverage. The percentages refer to % of Traditional (TRD) and Innovative (INN) KPIs covering 1,2,3 or 4 categories

Being the boundaries among the topics proposed (Product, Customer, Transactional, Area) quite fuzzy compared to the ones of KPIs which data stem from transactions, the results of category coverage analysis are consistent.

Indeed:

- 38% of Innovative KPIs covers one category (61% for traditional ones)
- 44% of Innovative KPIs covers two categories (36% for traditional ones)
- 19% of Innovative KPIs covers three categories (3% for traditional ones)
- None of innovative and traditional KPIs covers four categories

The last step of the analysis has been the usefulness classification of Innovative KPIs.

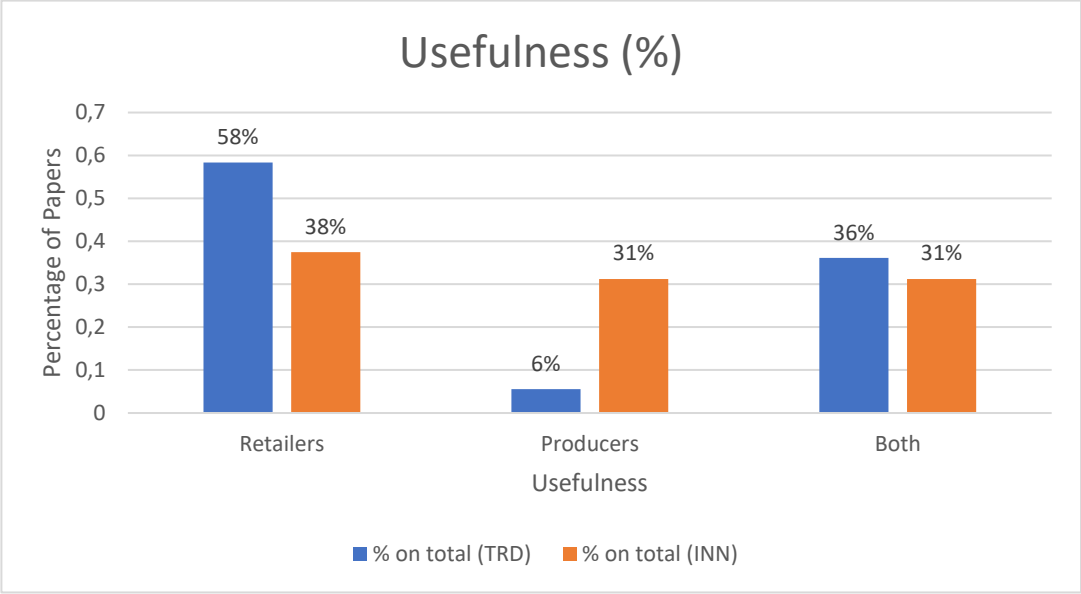


Figure 63. Usefulness. Percentages refer to % of Traditional (TRD) and Innovative (INN) KPIs classified as useful for each player or both

Since retailers are closer to the customers compared to CPG companies, they still remain the main informed type of player of what concerns the in-store shopping process. Nevertheless, CPG companies could have the possibility to increase their visibility and therefore their knowledge about what happens in the store.

This new KPIs allow to change the idea of the store, passing from a black box where what happens inside (i.e. shopping process) is not known, to a new store where different aspects related to customer behavior, profile, preferences, product performances at shelf, points of interactions (e.g. totems) become measurable and sources of valuable insights.

In this chapter, answer is provided to the research question *"How Digital Technologies create new opportunities for the definition of Innovative KPIs?".*

7. Solution

7.1 Introduction

During the research period spent in ACIN, it has been possible to work on the designing of an end-to-end solution which, leveraging on Digital Technology, drive the creation of an Innovative KPIs Measurement System. This solution is not a stand-alone one, but it is integrated with SAP Infrastructure, showing the perfect fit with one of the most used companies IT solutions provider.

Two of the Smart Grocery technologies previously described have been chosen:

- the laser registering customer interaction data near the shelf (i.e. Hitachi ToF)
- software based solution that through a cam registers ethnographic, mood, and attention (i.e. Quividi Cam)

Following, the solution is presented, considering all the technological challenges faced in the development and a possible scenario of implementation.

7.2 Solution development general overview

The following image describes the whole process of the data management.

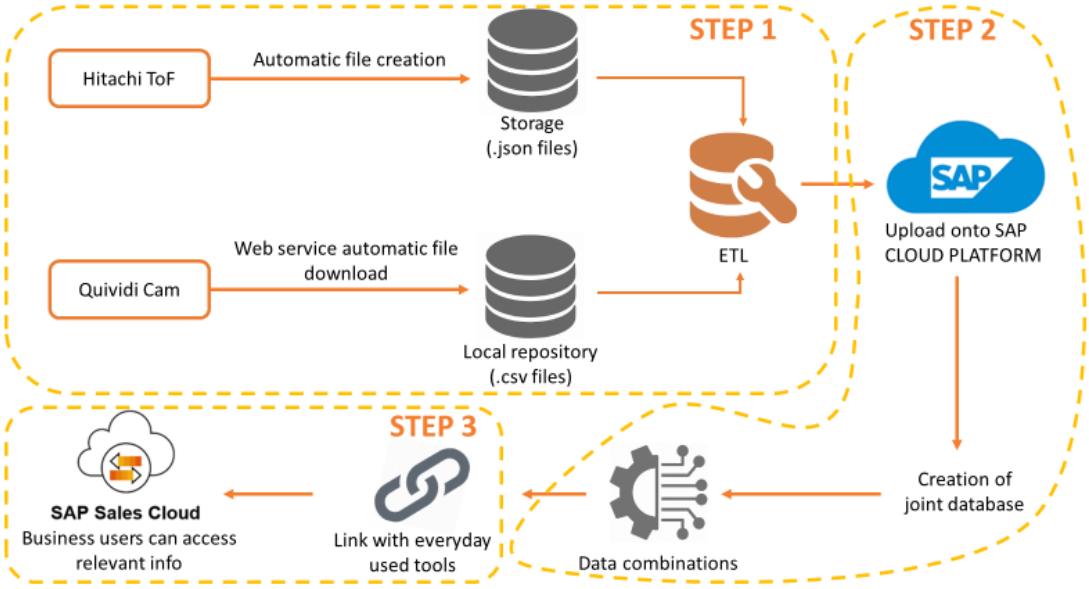


Figure 64. The Solution Steps

Starting from the data sources to end with the business user clear and intuitive interface, 3 main steps have been followed.

1. **The first step includes the study of the data sources**: the Hitachi ToF and the Quividi Cam. In this step, it has been essential to understand how data are registered (file format, interval time of file creation, where the files are stored…). Next, some practical tests have been carried out to get what different variables registered represent and understand their meaning. This allowed to proceed with a data reduction, since some variables have been considered as not relevant or redundant. Once data have been reduced, this step could be considered as ended.

2. **The second step has been to study a way to upload the files with the data registered on the SAP Cloud Platform** (furtherly explained), in order to be adjusted and to create a unique database, with a joint view. Once data are available in a unique view, it has been possible to combine them, in order to get some of the KPIs previously defined.

3. **The third and last step has been to think about a way to find a context in which the adoption of the new defined KPIs could properly fit**. In particular, it has been studied both the "technological aspect", that means finding a way to integrate different modules of SAP offering (Cloud Platform, Sales Cloud) and the "business aspect", understanding in which scenario this solution could be applied, coming out with the Perfect Store scenario, described in the next pages.

7.3 SAP Offering Overview

7.3.1 Introduction

To better show the SAP tools used during the development of this end-to-end solution, in the following part, a little focus will be provided. A clear understanding of how this tools work, their capabilities and how they position in the SAP world is crucial for a complete comprehension of the entire solution. In the first part the focus will be on the SAP Cloud Platform, while on the second on the C/4 HANA Suite and SAP Sales Cloud.

7.3.2 The SAP Cloud Platform inside SAP Intelligent Enterprise

SAP Cloud Platform (SCP) is an open platform as a service that provides in-memory database and application services. It is a focal part of the innovative SAP Intelligent Enterprise Framework, shown by the picture. The Intelligent Enterprise is mainly made up of three components: an Intelligent Suite of application (refer to image), a set of Intelligent Technologies interface tools (i.e. tool to connect IoT, AI, ML, Analytics) that is called SAP Leonardo and a Digital Platform that is made by SAP HANA Data Management Suite and SAP Cloud Platform.

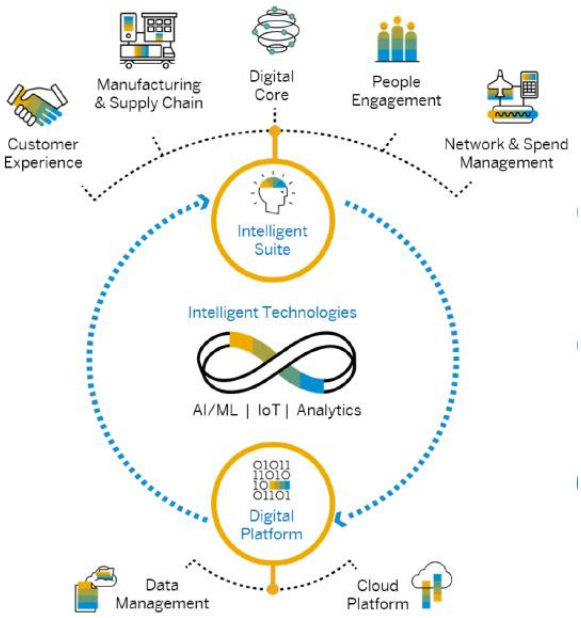


Figure 65. SAP Intelligent Enterprise

The SAP Cloud Platform is targeted to provide enterprises the flexibility and speed in the development of business applications as customers and employees demand better experiences and high adaptability to their needs.
It enables companies in:

1. enabling customers and partners to easily extend SAP intelligent suite with their own innovative capabilities
2. integrating it with third party solutions without any friction

3. building new applications that have high impact on business processes.
4. serving SAP internally for integrating and embedding SAP Leonardo capabilities into the intelligent suite, allowing to further increase productivity and value to customers.

In an era in which data play a vital role in all decision-making and business processes, having the ability to manage big X-data (i.e. data related to customer experience) and O-data (i.e. data stemming from operations processes), gaining new levels of business insights, and turning them into impactful actions is an absolute key to success. As business data volume grows exponentially, and as enterprises have access to an abundance of new intelligent technologies, players have countless opportunities to influence experiences and reimagine their business processes through data-driven innovation. The image below shows how superior business insights comes from the collection of X and O data with SAP solution.

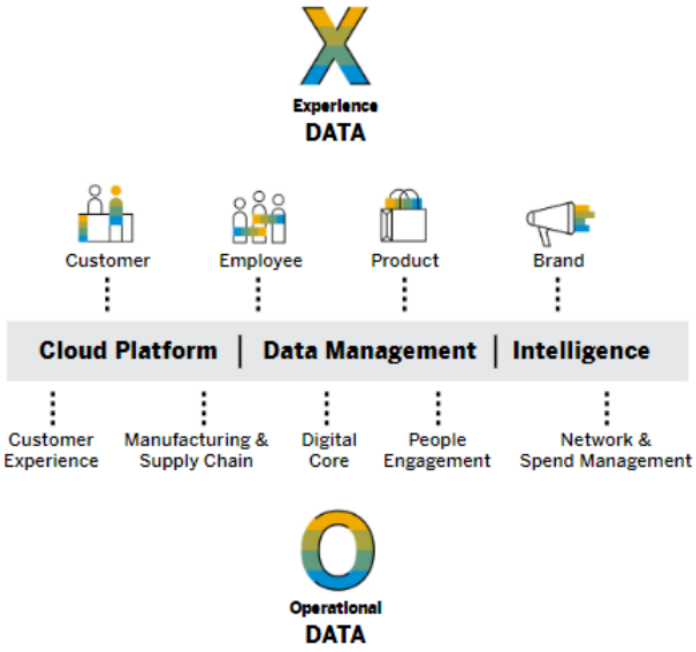


Figure 66. X and O-data in SAP Solution

The SAP Cloud Platform gathers numerous capabilities like:

1. Artificial Intelligence and Machine Learning
2. Analytics
3. Blockchain
4. Data Management

5. Developer Experiences
6. Integration
7. Internet of Things
8. Master Data
9. Mobile
10. Rates and Measures
11. User Experience
12. User Management

As these are only the most important capabilities, it is easily understandable how this tool is powerful and how greatly it can impact different business. For the solution purpose, that is the development of an Innovative KPIs Measurement System, only few capabilities have been exploited, in particular, Analytics and Data Management.

7.3.3 SAP C/4 HANA Suite

In the SAP Intelligent Enterprise framework, the customer experience is entirely managed by the SAP C/4 HANA suite. In this acronym, the C stands for Customer Experience, 4 because it is the fourth generation of CRM and HANA is the business data platform on which the suite leverages. Inside the C/4 HANA suite, as it has possible to see in the image below, there are different modules, covering different processes and aspects of the customer experience.

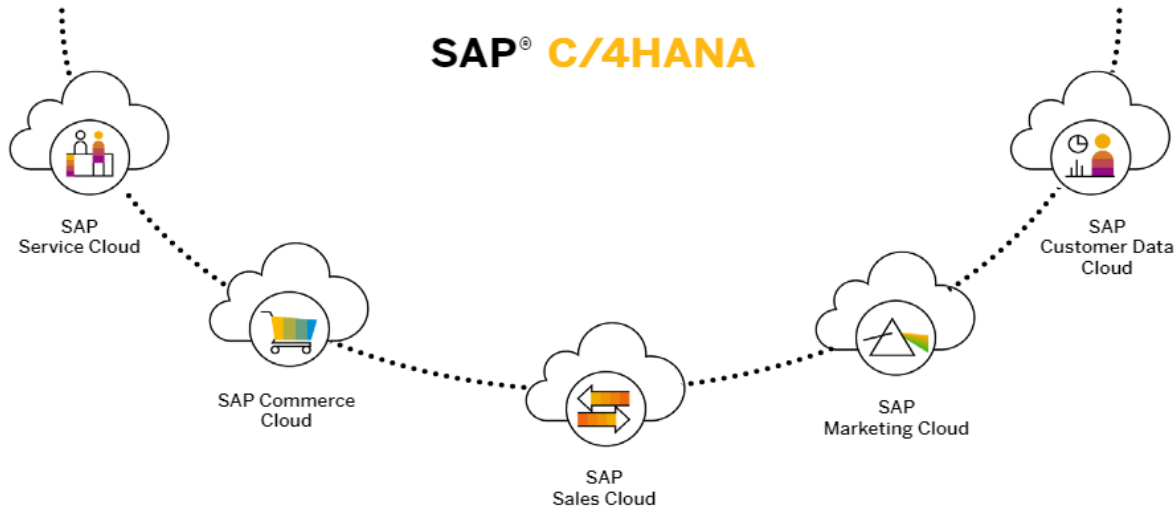


Figure 67. SAP C/4 Hana Modules

The modules are:

1. SAP Service Cloud
2. SAP Commerce Cloud
3. SAP Sales Cloud
4. SAP Marketing Cloud
5. SAP Customer Data Cloud

Service Cloud covers the aspects related to the delivery of the services focusing on enabling effortless self-service, supporting omnichannel customer engagement, providing on-demand field service and bridging the back-end systems with the front-end ones.

Commerce Cloud manages all the aspects related to the commerce platform market: the main objective of this tool is to enable a personalized, joint and seamless experience across the different channels which a typical commerce platform exploits.

Marketing Cloud covers the marketing process, from the creation of a campaign to the analysis of the performances and insights generation through different channels.

Customer Data Cloud allows the management of all the data collected by a company during every interaction with its customers, in compliancy with Privacy and Security regulations.

Sales Cloud focuses on the sales representative experience, improving it reducing non-added value activities, making their daily tasks faster and efficient. Consequently, a better sales representative experience enhances a better customer experience.

These five modules are strictly connected, as their integration allows the delivery of the end-to-end, personalized and seamless Customer Experience delivery process. Moreover, the integration of the C/4 HANA Suite with the SAP Cloud Platform allows company to exploit innovative technologies like, blockchain, IoT, virtual and augmented reality in the CX delivery process, improving more and more the value for the customer. As a matter of fact, the solution leverage on an integration of SCP and Sales Cloud. The image below shows C/4 HANA and SCP framework.

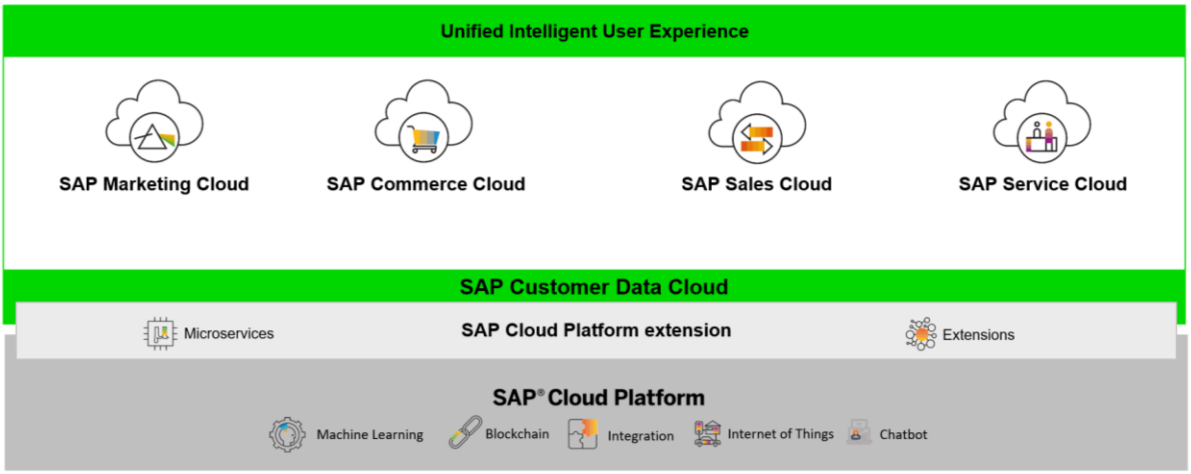


Figure 68. SAP C/4 Hana and SCP Layers

7.3.4 SAP Sales Cloud

Sales Cloud (also known as Cloud for Customer), as just said, is one of the five modules of the C/4 HANA suite. It is also the one used to complete the end-to-end solution developed in the ACIN Grocery. Sales Cloud presents several capabilities:

1. Sales learning
2. Sales content
3. Partner relationship management
4. Configure price quote
5. Contract lifecycle management
6. Sales performance management
7. Intelligent forecasting
8. Subscription, billing and revenue management
9. Lead, opportunity and account management

Logging in his account, each sales representative can see dashboards, reports, stores' scoring and other different information. With the solution, developed and integrated with Sales Cloud, each sales rep could access also to different KPIs (different from transactional ones) and deliver a value-added customer experience to retailers firstly; secondly, CPG companies could obtain extremely meaningful information on how their products are performing in each retailer.

In the following part, the solution development will be presented following the three-steps framework shown at the beginning of this chapter.

7.4 Data sources preliminary study

7.4.1 Hitachi Output preliminary study

As mentioned, the solution relies on the integration between the Quividi Software and the Hitachi ToF previously described, since they seem to register data that, if properly integrated, could provide most interesting information.

The first step carried out has been the analysis of the output of the two tools; in particular, it is needed to know both the structure of the data gathered and their flow.

The Hitachi Laser ToF registers .json files each one with an interval of some seconds (the interval time of upload is variable and does not follow a defined logic). The files are saved in a folder of a local NUC, a mini-PC that is connected directly to the laser. A .json file is registered both when there are relevant data (customers in front of shelf) and even if nothing relevant has been registered (empty file). Being registered every X seconds (X is a quantity variable but very low: max around 10), there is a quite huge number of files, each of them very small size (it is just of some KB).


```
[["2019/04/16 16:40:24.684000",2,"Appear","-700.521423","648.991760","692.508423","-120.206566",0,"0.000000","-1.000000","-1.000000","-1.000000"],
["2019/04/16 16:40:24.684000",2,"Walk","-700.521423","648.991760","692.508423","-120.206566",260,"1791.387939","-1.000000","-1.000000","-1.000000"],
["2019/04/16 16:40:24.760000",2,"Walk","-639.978088","636.381287","776.196533","-161.672699",258,"1773.440430","-1.000000","-1.000000","-1.000000"],
["2019/04/16 16:40:24.871000",2,"Walk","-573.377991","619.075684","605.455627","-157.323837",255,"1754.904297","-1.000000","-1.000000","-1.000000"],
["2019/04/16 16:40:24.946000",2,"Walk","-517.481995","600.504333","716.615112","-238.094467",251,"1797.009155","-1.000000","-1.000000","-1.000000"],
["2019/04/16 16:40:25.041000",2,"Walk","-459.931213","581.247925","612.242310","-204.855148",251,"1799.419067","-1.000000","-1.000000","-1.000000"],
["2019/04/16 16:40:25.135000",2,"Walk","-405.023376","565.029114","590.406738","-174.395508",253,"1799.983887","-1.000000","-1.000000","-1.000000"],
["2019/04/16 16:40:25.230000",2,"Walk","-360.595276","552.652100","472.639557","-131.670227",254,"1798.455078","-1.000000","-1.000000","-1.000000"],
["2019/04/16 16:40:25.322000",2,"Walk","-320.604919","545.262390","425.429260","-78.614143",259,"1796.671387","-1.000000","-1.000000","-1.000000"],
["2019/04/16 16:40:25.415000",2,"Walk","-284.244812","541.140564","386.809753","-43.849495",263,"1797.889893","-1.000000","-1.000000","-1.000000"],
["2019/04/16 16:40:25.495000",2,"Walk","-251.461853","539.488159","420.294434","-21.184542",267,"1795.744507","-1.000000","-1.000000","-1.000000"],
["2019/04/16 16:40:25.606000",2,"Walk","-210.229553","538.692322","378.278046","-7.301483",268,"1797.613770","-1.000000","-1.000000","-1.000000"],
["2019/04/16 16:40:25.680000",2,"Walk","-174.863373","538.460327","453.412476","-2.974325",269,"1799.522949","-1.000000","-1.000000","-1.000000"],
["2019/04/16 16:40:25.792000",2,"Walk","-135.313034","538.670837","359.548492","1.913959",270,"1793.738525","-1.000000","-1.000000","-1.000000"],
["2019/04/16 16:40:25.870000",2,"Walk","-104.053879","538.356018","400.758423","-4.036417",269,"1798.430664","-1.000000","-1.000000","-1.000000"],
["2019/04/16 16:40:25.962000",2,"Walk","-76.650009","536.541504","294.665283","-19.510769",269,"1797.160889","-1.000000","-1.000000","-1.000000"],
```


Figure 69. Hitachi .Json File

The .json file is not quite easy to read and, as already described, registered different data. To understand what the data gathered represents in the .json file, some practical tests have been carried out, trying to behave in different ways in front of the shelf and

later analyzing the output basically to match the behavior with the data and understand how to read them.

This is how a .json file displays once opened. There are quite like .csv, since each column is separated to increase the readability in the studying phase, test .json files have been transferred to Microsoft Excel to obtain something similar to the following image.

	A	B	C	D	E	F	G	H	I	J	K	L
1												
2	time	ID	status	x	y			direction (human)	head height	height-touch	x-touch	depht-touch
3	["2019/02/06 19:11:30.018000"	1021	StandHand	-480,535,706	295,748,169	-2,882,705	-3,640,937	193	1,799,791,260	1,734,875,000	-499,000,000	200.000000]
4	["2019/02/06 19:11:30.373001"	1030	StandHand	141,417,755	518,475,891	-6,485,137	-1,845,490	114	1,730,619,141	-1,000,000	-1,000,000	-1.000000]
5	["2019/02/06 19:11:30.931003"	1037	Crouch	-941,806,030	1,178,743,774	-398,620,728	-183,434,265	135	1,391,426,636	-1,000,000	-1,000,000	-1.000000]
6	["2019/02/06 19:11:31.387002"	1035	Stand	-204,874,329	1,265,003,296	47,087,547	-7,752,892	234	1,438,438,477	-1,000,000	-1,000,000	-1.000000]
7	["2019/02/06 19:11:31.477002"	1035	Crouch	-203,489,761	1,265,255,859	14,729,404	2,687,200	234	1,427,240,356	-1,000,000	-1,000,000	-1.000000]
8	["2019/02/06 19:11:31.585000"	1021	StandHand	-481,306,793	290,788,422	4,419,092	-5,451,395	220	1,799,617,188	1,666,541,748	-499,000,000	200.000000]
9	["2019/02/06 19:11:31.586002"	1035	Stand	-204,797,607	1,267,019,165	-11,998,577	16,177,120	234	1,445,212,280	-1,000,000	-1,000,000	-1.000000]
10	["2019/02/06 19:11:31.775000"	1021	StandHand	-480,592,865	289,735,718	1,892,465	-5,083,998	254	1,865,018,066	-1,000,000	-1,000,000	-1.000000]
11	["2019/02/06 19:11:31.775002"	1035	Crouch	-213,882,095	1,271,513,306	-39,448,738	17,875,689	234	1,425,997,070	-1,000,000	-1,000,000	-1.000000]
12	["2019/02/06 19:11:32.135000"	1021	StandHand	-488,212,494	287,157,532	-38,240,761	-18,573,742	194	1,792,710,571	-1,000,000	-1,000,000	-1.000000]
13	["2019/02/06 19:11:32.588001"	1030	StandHand	147,880,432	543,753,662	-9,309,504	4,055,808	144	1,685,909,180	-1,000,000	-1,000,000	-1.000000]
14	["2019/02/06 19:11:32.775001"	1030	StandHand	138,676,849	549,050,354	-59,275,818	33,159,409	209	1,702,182,861	-1,000,000	-1,000,000	-1.000000]
15	["2019/02/06 19:11:32.967003"	1037	Disappear	-1,088,712,891	1,541,015,869	76,782,242	517,337,646	175	321,429,443	-1,000,000	-1,000,000	-1.000000]
16	["2019/02/06 19:11:33.149001"	1030	StandHand	96,167,923	550,572,571	-154,809,494	-7,761,678	55	1,757,453,857	-1,000,000	-1,000,000	-1.000000]
17	["2019/02/06 19:11:33.337001"	1030	StandHand	78,024,117	541,175,232	-71,931,770	-48,607,075	51	1,791,725,830	-1,000,000	-1,000,000	-1.000000]
18	["2019/02/06 19:11:34.351001"	1030	StandHand	524,856,934	923,757,690	-79,824,997	-13,121,628	131	1,689,565,430	-1,000,000	-1,000,000	-1.000000]
19	["2019/02/06 19:11:35.086004"	1038	Appear	-1,180,409,912	1,536,341,553	173,290,237	141,259,399	0	0.000000	-1,000,000	-1,000,000	-1.000000]
20	["2019/02/06 19:11:35.086004"	1038	Walk	-1,180,409,912	1,536,341,553	173,290,237	141,259,399	357	1,042,787,354	-1,000,000	-1,000,000	-1.000000]
21	["2019/02/06 19:11:35.275001"	1030	StandHand	563,084,961	950,023,987	11,004,715	-35,961,269	131	1,713,315,796	-1,000,000	-1,000,000	-1.000000]
22	["2019/02/06 19:11:35.275004"	1038	Walk	-1,111,963,257	1,378,419,556	354,570,923	-1,207,139,893	196	1,185,446,655	-1,000,000	-1,000,000	-1.000000]

Figure 70. Hitachi ToF Excel File

In the second row of the file, referring to the above image, there is written what data of a single column represent.

So, data registered are:

1. Timestamp: it indicates the moment other columns data refer to
2. ID: it gives the possibility to understand the client other columns refer to
3. Status: this column describes the position the customer has in that specific moment (stand-hand, walk, crouch, stand). It could be also “appearing” and “disappearing” in the first and in the last moment a client is registered by ToF).
4. X: it is the abscissa position the customer has on the floor by a laser reference system.
5. Y: it is the order position the customer has on the floor by a laser reference system.
6. -- the meaning of this is not known
7. – as for 6, the meaning of this column is not known

8. Direction: it identifies the rotation angle the customer has when compared to the shelf (it ranges from 0 to 360 degrees)
9. Head height: this provides a measure of the height of the head of the customer from the floor
10. Y-touch: this gives the registration of the height of the hand picking a product on the shelf
11. X- touch: the abscissa measure of the hand interacting with the shelf
12. Depth touch: it provides an info regarding the depth that is reached by the hand of the customer interacting with the shelf (in this export it seems to be a binary variable, but with accurate configuration it has been proved that it is a float one)

Once understood the meaning of these raw data, the following step concerning Hitachi output has been manipulating the file in order to make it cleaner and consider just what is needed.

Through the elimination of not useful columns, the output of Hitachi has been transformed considering only the variable in the following image.

	A	B	C	D	E	F
1	timestamp	ID	status	Y_shelf	X_shelf	Interaction
2	["2019/02/06 19:11:30"	1021	StandHand	1,734,875,000	-499,000,000	200.000000]
3	["2019/02/06 19:11:30"	1030	StandHand	-1,000,000	-1,000,000	-1.000000]
4	["2019/02/06 19:11:30"	1037	Crouch	-1,000,000	-1,000,000	-1.000000]
5	["2019/02/06 19:11:31"	1035	Stand	-1,000,000	-1,000,000	-1.000000]
6	["2019/02/06 19:11:31"	1035	Crouch	-1,000,000	-1,000,000	-1.000000]
7	["2019/02/06 19:11:31"	1021	StandHand	1,666,541,748	-499,000,000	200.000000]
8	["2019/02/06 19:11:31"	1035	Stand	-1,000,000	-1,000,000	-1.000000]
9	["2019/02/06 19:11:31"	1021	StandHand	-1,000,000	-1,000,000	-1.000000]
10	["2019/02/06 19:11:31"	1035	Crouch	-1,000,000	-1,000,000	-1.000000]
11	["2019/02/06 19:11:32"	1021	StandHand	-1,000,000	-1,000,000	-1.000000]
12	["2019/02/06 19:11:32"	1030	StandHand	-1,000,000	-1,000,000	-1.000000]
13	["2019/02/06 19:11:32"	1030	StandHand	-1,000,000	-1,000,000	-1.000000]
14	["2019/02/06 19:11:32"	1037	Disappear	-1,000,000	-1,000,000	-1.000000]
15	["2019/02/06 19:11:33"	1030	StandHand	-1,000,000	-1,000,000	-1.000000]
16	["2019/02/06 19:11:33"	1030	StandHand	-1,000,000	-1,000,000	-1.000000]
17	["2019/02/06 19:11:34"	1030	StandHand	-1,000,000	-1,000,000	-1.000000]
18	["2019/02/06 19:11:35"	1038	Appear	-1,000,000	-1,000,000	-1.000000]

Figure 71. Hitachi ToF Reduced Excel FIle

The depth is not relevant as a float, the column has been kept in order to understand if the customer interacts or not. So, when there is an interaction there is something different by -1.0000 as value.

The preliminary study of the output of the Hitachi ToF ended here.

7.4.2 Quividi Output preliminary study

As done for ToF, knowing how Quividi Cam registers data has been essential. The data are registered in reports that could be downloaded in .csv format files from the dedicated website. In the study phase they have been converted into excel for having a cleaner view.

Following is provided the view of the website for the download and the excel file (obtained by the .csv). (The time interval of data about to be download is manually set by the user).

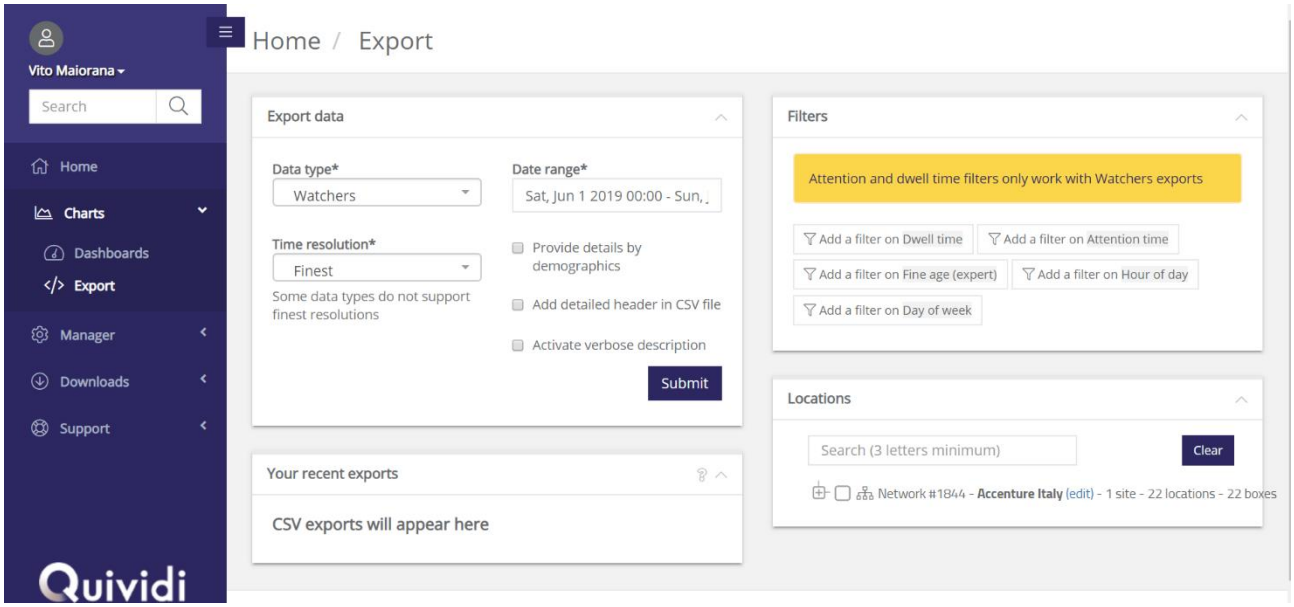


Figure 72. Quividi Download WebPage

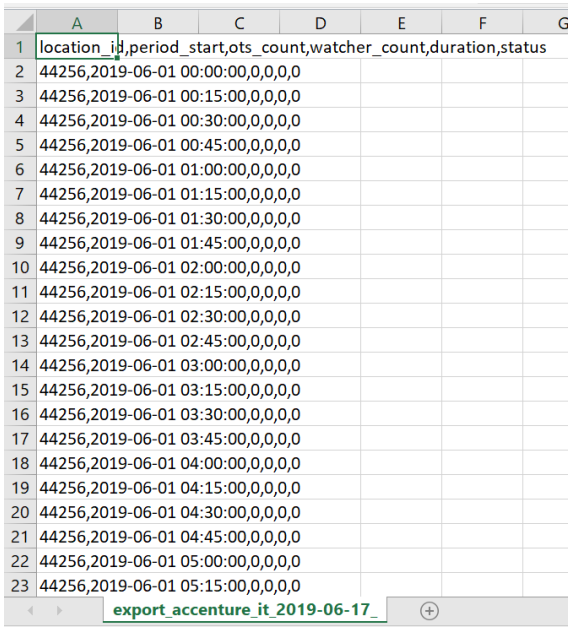
The first raw of the .csv tells what each column represents (consider that only customer paying at least a moment of attention are registered)

1. Location_id data refers to where the data has been collected
2. Period start: moment in which the client starts to be registered
3. Age: estimation of age of client registered
4. Age_value: info about the age but expressed as a categoric variable

5. Glasses: is the customer wearing glasses or not?
6. Mustache: does customer have mustache?
7. Beard: does customer have beard?
8. 5 mood variables: mood is registered in a way. There are 5 status (very unhappy, unhappy, neutral, happy, very happy). The software considers an amount of 100 points to split among the different moods. Each column reports the percentage of the time spent paying attention by the customer feeling that specific mood.
9. Dwell time: time the customer is registered by the cam
10. Attention time: time the customer is paying attention to the shelf

As for the Hitachi, some variable considered not useful for the purpose of this work have been rejected. Age value provides an info quite similar to age, it is redundant, so it has been eliminated. Then, 5 variables for the mood are quite inefficient from a data elaboration perspective. So, a new column reporting Average mood has been created, summarizing the five starting variables. Since there is only a Quividi installed available, also the location_id has been discarded.

Still talking about Quividi, also another table needs to be used. It is the one reporting data regarding the watchers and the OTS. It is quite simple as column and does not require any integration with the other tables. So only the download and uploading in the platform is needed.



	A	B	C	D	E	F	G
1	location_id,period_start,ots_count,watcher_count,duration,status						
2	44256,2019-06-01 00:00:00,0,0,0,0						
3	44256,2019-06-01 00:15:00,0,0,0,0						
4	44256,2019-06-01 00:30:00,0,0,0,0						
5	44256,2019-06-01 00:45:00,0,0,0,0						
6	44256,2019-06-01 01:00:00,0,0,0,0						
7	44256,2019-06-01 01:15:00,0,0,0,0						
8	44256,2019-06-01 01:30:00,0,0,0,0						
9	44256,2019-06-01 01:45:00,0,0,0,0						
10	44256,2019-06-01 02:00:00,0,0,0,0						
11	44256,2019-06-01 02:15:00,0,0,0,0						
12	44256,2019-06-01 02:30:00,0,0,0,0						
13	44256,2019-06-01 02:45:00,0,0,0,0						
14	44256,2019-06-01 03:00:00,0,0,0,0						
15	44256,2019-06-01 03:15:00,0,0,0,0						
16	44256,2019-06-01 03:30:00,0,0,0,0						
17	44256,2019-06-01 03:45:00,0,0,0,0						
18	44256,2019-06-01 04:00:00,0,0,0,0						
19	44256,2019-06-01 04:15:00,0,0,0,0						
20	44256,2019-06-01 04:30:00,0,0,0,0						
21	44256,2019-06-01 04:45:00,0,0,0,0						
22	44256,2019-06-01 05:00:00,0,0,0,0						
23	44256,2019-06-01 05:15:00,0,0,0,0						

export_accenture_it_2019-06-17_

Figure 73. Watchers Raw Data

The variables registered in the files of this type are essentially 4:

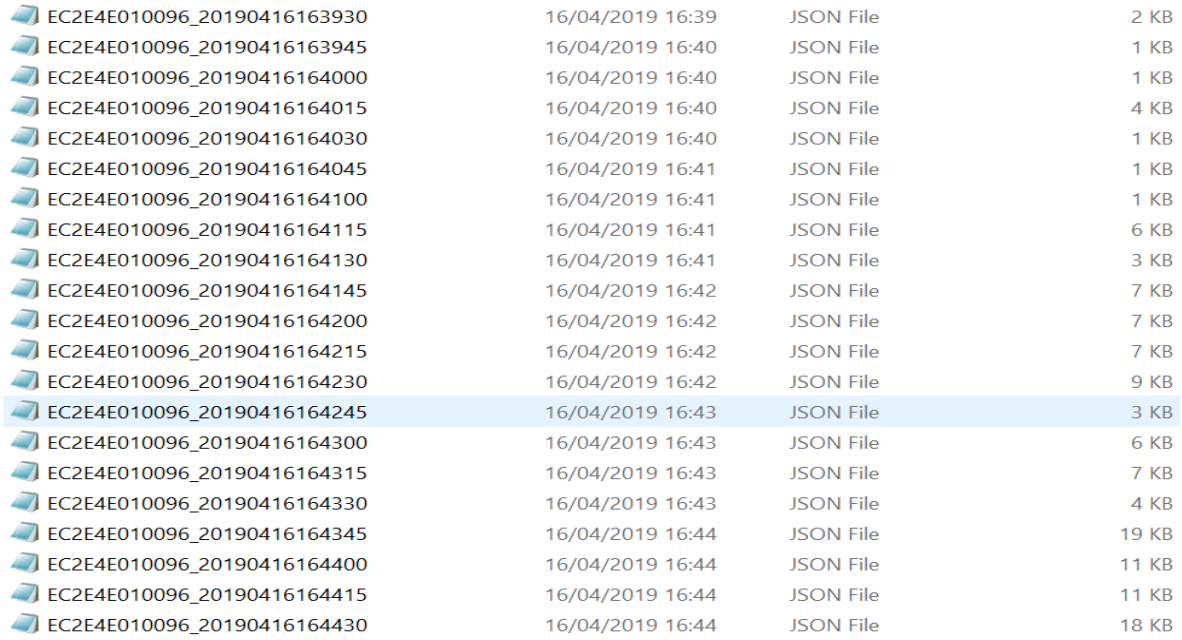
1) Location_id: it indicates the location data refer to
2) Period start: this indicates the timeframe data refer to
3) OTS_count : it is the count of the people passed near the shelf and defined as Opportunity to See (people that do not pay attention to the shelf)
4) Watchers_count : it is the count of the people passed near the shelf that paid attention at least for a while to the shelf
5) Duration: this variable indicates how many seconds the customer paid attention

The last variable, status, is something not relevant and has been discarded.

7.5 How to upload files and feed the database: SAP CLOUD PLATFORM

7.5.1 Hitachi ToF section

Another of the most important challenges to face has been the collection of files from the sources. As already mentioned, the Hitachi registrations in .json files are automatically created by the device and stored in the NUC. While for Quividi reports are not stored on a local memory but is possible to download them.



EC2E4E010096_20190416163930	16/04/2019 16:39	JSON File	2 KB
EC2E4E010096_20190416163945	16/04/2019 16:40	JSON File	1 KB
EC2E4E010096_20190416164000	16/04/2019 16:40	JSON File	1 KB
EC2E4E010096_20190416164015	16/04/2019 16:40	JSON File	4 KB
EC2E4E010096_20190416164030	16/04/2019 16:40	JSON File	1 KB
EC2E4E010096_20190416164045	16/04/2019 16:41	JSON File	1 KB
EC2E4E010096_20190416164100	16/04/2019 16:41	JSON File	1 KB
EC2E4E010096_20190416164115	16/04/2019 16:41	JSON File	6 KB
EC2E4E010096_20190416164130	16/04/2019 16:41	JSON File	3 KB
EC2E4E010096_20190416164145	16/04/2019 16:42	JSON File	7 KB
EC2E4E010096_20190416164200	16/04/2019 16:42	JSON File	7 KB
EC2E4E010096_20190416164215	16/04/2019 16:42	JSON File	7 KB
EC2E4E010096_20190416164230	16/04/2019 16:42	JSON File	9 KB
EC2E4E010096_20190416164245	16/04/2019 16:43	JSON File	3 KB
EC2E4E010096_20190416164300	16/04/2019 16:43	JSON File	6 KB
EC2E4E010096_20190416164315	16/04/2019 16:43	JSON File	7 KB
EC2E4E010096_20190416164330	16/04/2019 16:43	JSON File	4 KB
EC2E4E010096_20190416164345	16/04/2019 16:44	JSON File	19 KB
EC2E4E010096_20190416164400	16/04/2019 16:44	JSON File	11 KB
EC2E4E010096_20190416164415	16/04/2019 16:44	JSON File	11 KB
EC2E4E010096_20190416164430	16/04/2019 16:44	JSON File	18 KB

Figure 74. .Json File Local Folder

As it has been possible to see in the screenshot, in only a minute of registration the Hitachi generates many files, each one with a very low weight. Some of them are even weighting just 1 KB; this means that there is nothing written in the file.

In order to work with better organized data, all the empty files should be deleted to keep just the ones with relevant data. Moreover, there is no need of having real-time upload of those onto the platform, but it is reasonable to consider an upload time not so high, to have a good compromise solution. It is not efficient to upload each file one by one, so the decision taken has been uploading with a constant interval of time (let's say around half an hour).

With this premise, the solution found has been to develop a script (coded in Python) that locally works on the .json files. The first step carried out has been deleting all the empty files that do not provide relevant data. Then, as already mentioned, it is appropriate to merge all the files related to a specific timeframe (let's say half an hour). Finally, the step carried out has been manipulating the just generated file in to get the final files described in the previous paragraphs, aiming at having as cleaner as possible data.

7.5.2 Quividi section

For the Quividi cam, the situation is quite different. There is the need of develop a way to automatically download the report by the Quividi portal, manipulate it to delete all the data not needed and obtain date stored in files as the ones described in the previous paragraphs.

As for the Hitachi ToF, there is no need to have real-time data so there is a download of a report from the Quividi Portal every X minutes.

7.5.3 Joint view

The following step has been to think about a way to integrate the data gathered by the Quividi and the ones of Hitachi, considering the two formats of their output.

To do this, the only possibility is given by the Timestamp since it is the only field in common. Since the timestamp is not registered in the same identical way from the devices, some arrangements have to be carried out. In fact, the Hitachi timestamp format considers also the milliseconds, while the Quividi stops at seconds. Moreover, the Hitachi provides much more registrations if compared to Quividi.

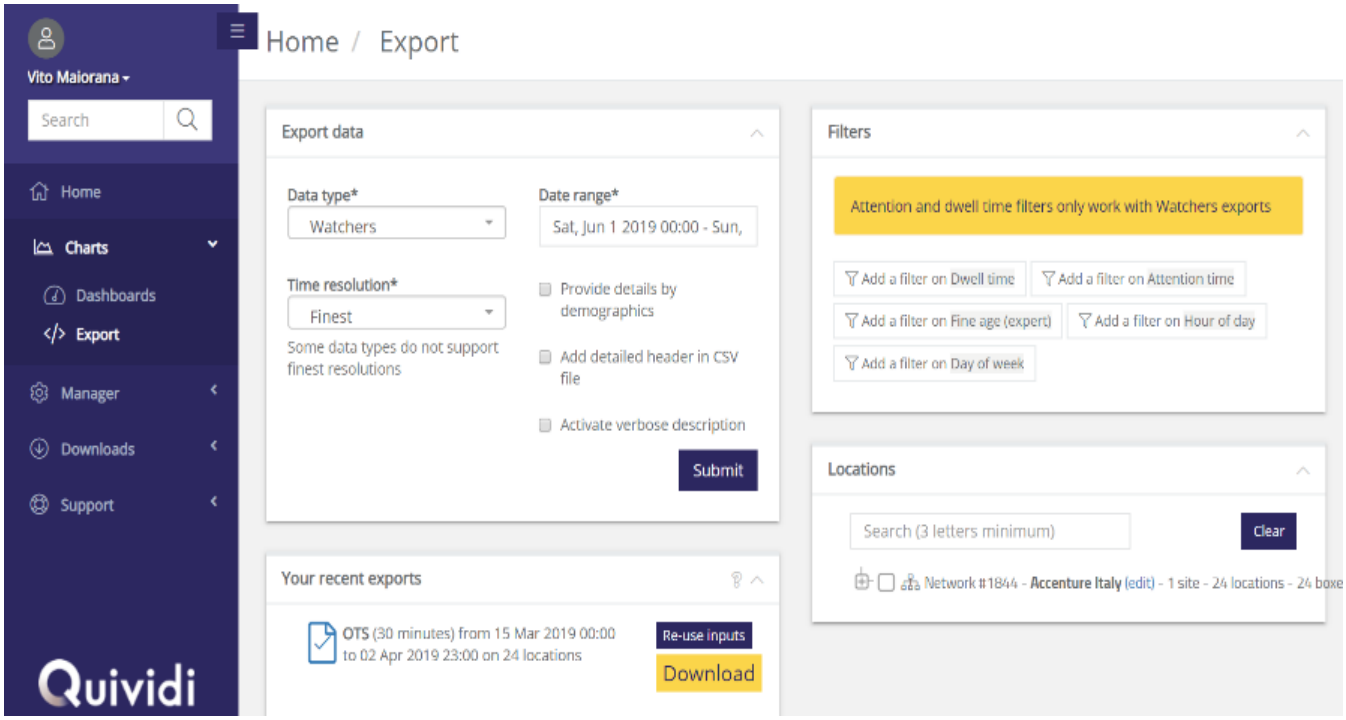


Figure 75. Quividi Download WebPage

This has been a strong challenge to face, since the creation of a joint database requires the same number of rows.

Since the ToF provides almost a registration per second, the set of Quividi registration is contained in the one of the Hitachi ToF. So, the solution found has been to firstly match the Quividi registrations with the Hitachi's ones. Secondly, to complete the row of Hitachi rows that have no a correspondence, the previous Quividi one is duplicated, until a new registration of Quividi is present and matched with Hitachi's one. This logic for the creation of the joint database is simplified and shown in the following table.

HITACHI 001	QUIVIDI 001
HITACHI 002	QUIVIDI 001
HITACHI 003	QUIVIDI 001
HITACHI 004	QUIVIDI 002
HITACHI 005	QUIVIDI 003
HITACHI 006	QUIVIDI 003
HITACHI 007	QUIVIDI 003
HITACHI 008	QUIVIDI 003

Figure 76. Joint View Logic

This integration makes sense because the registration provided by the Quividi refers to a customer during his whole stay in front of the shelf, so it is like a sort of summary of his behavior. On the other side, the Hitachi ToF provides a registration for each second of the customer staying in front of shelf.

As already mentioned, starting from the joint database, the number of columns has been increased to introduce elements useful for calculating KPIs (e.g. Average Mood). Also, some simple KPIs are computed directly as well. The logic behind the computation of this new columns is basically in SQL, replicating the formulas described in the KPIs section for the most of the KPIs.

7.5.4 The Database output

After the creation of the joint view, the KPIs Measurement System started providing information. The following images show a part of the joint view.

Raw Data | Distinct values | Analysis | Show Log | Max rows: 200

Filter pattern | 32 rows retrieved - 118 ms | Execute | Add filter | Sort entire data set

TIME	ID	STATUS	Y_SHELF	X_SHELF	INTERACTION	CATEGORY	PRODUCT
08/05/2019 19:05:28	21	StandHand	1.025,75	-469,961731	70,953125	BIBITE GASATE	Aranciata San Pellegrino Blu
08/05/2019 19:05:53	23	StandHand	1.102,75	-420,119537	71,921875	BIBITE GASATE	Aranciata San Pellegrino Blu
08/05/2019 19:06:11	25	StandHand	1.076,5	-469,961731	70,953125	BIBITE GASATE	Aranciata San Pellegrino Blu
08/05/2019 19:00:16	5	StandHand	1.052	-269,789063	74,84375	BIBITE GASATE	Aranciata San Pellegrino Verde
08/05/2019 19:02:52	15	StandHand	1.200,75	-344,552338	73,390625	BIBITE GASATE	Aranciata San Pellegrino Verde
08/05/2019 19:04:41	18	StandHand	1.150	-369,47345	72,90625	BIBITE GASATE	Aranciata San Pellegrino Verde
08/05/2019 19:05:48	23	StandHand	1.200,75	-344,552338	73,390625	BIBITE GASATE	Aranciata San Pellegrino Verde
08/05/2019 19:06:14	25	StandHand	1.102,75	-394,394531	72,421875	BIBITE GASATE	Aranciata San Pellegrino Verde
08/05/2019 19:03:16	17	StandHand	1.227	-70,420319	78,71875	BIBITE GASATE	Spumador
08/05/2019 18:59:41	1	StandHand	1.127,25	5,146851	80,1875	BIBITE GASATE	Ginger
08/05/2019 19:01:54	11	StandHand	1.227	5,146851	80,1875	BIBITE GASATE	Ginger
08/05/2019 19:02:20	13	StandHand	1.025,75	79,910156	81,640625	BIBITE GASATE	Pepsi
08/05/2019 19:02:54	15	StandHand	1.102,75	104,831238	82,125	BIBITE GASATE	Pepsi
08/05/2019 19:04:39	18	StandHand	1.176,25	205,319519	84,078125	BIBITE GASATE	Pepsi
08/05/2019 19:04:46	18	StandHand	1.001,250061	104,831238	82,125	BIBITE GASATE	Pepsi
08/05/2019 19:05:26	21	StandHand	1.052	104,831238	82,125	BIBITE GASATE	Pepsi
08/05/2019 19:05:51	23	StandHand	1.076,5	79,910156	81,640625	BIBITE GASATE	Pepsi
08/05/2019 18:59:52	4	StandHand	1.025,75	329,924988	86,5	BIBITE GASATE	Coca Cola
08/05/2019 19:00:57	8	StandHand	1.052	354,846069	86,984375	BIBITE GASATE	Coca Cola
08/05/2019 19:02:01	11	StandHand	1.127,25	305,003906	86,015625	BIBITE GASATE	Coca Cola
08/05/2019 19:03:04	15	StandHand	1.127,25	305,003906	86,015625	BIBITE GASATE	Coca Cola
08/05/2019 19:05:08	20	StandHand	1.127,25	329,924988	86,5	BIBITE GASATE	Coca Cola
08/05/2019 19:05:56	23	StandHand	1.025,75	329,924988	86,5	BIBITE GASATE	Coca Cola
08/05/2019 19:06:12	25	StandHand	1.076,5	230,240601	84,5625	BIBITE GASATE	Coca Cola

Figure 77. SAP Cloud Platform DB View 1

Analysis | Distinct values | Raw Data

Filter pattern | 9 rows retrieved - 398 ms

AVG_MOOD	ID_1	INTERACTION_1	ATTENTION_RATE
0,523529412	4	86,5	0,8395061728395061
0,523529412	4	86,5	0,8395061728395061
0,42745098	11	80,1875	0,9293478260869565
0,507843137	15	73,390625	0,9537366548042705
0,507843137	15	73,390625	0,9537366548042705
0,515686274	17	71,921875	0,6829268292682927
0,318627445	18	84,078125	0,8505747126436781
0,535294125	23	73,390625	0,6486486486486487
0,535294125	23	73,390625	0,6486486486486487

Figure 78. SAP Cloud Platform DB View 2

The information provided as output are a series of KPIs filtered per gender or product. Here below some examples taken from a test made in the Smart Grocery (note that for graphic matters, the images are not the one taken from the SAP Cloud Platform but have been redesigned).

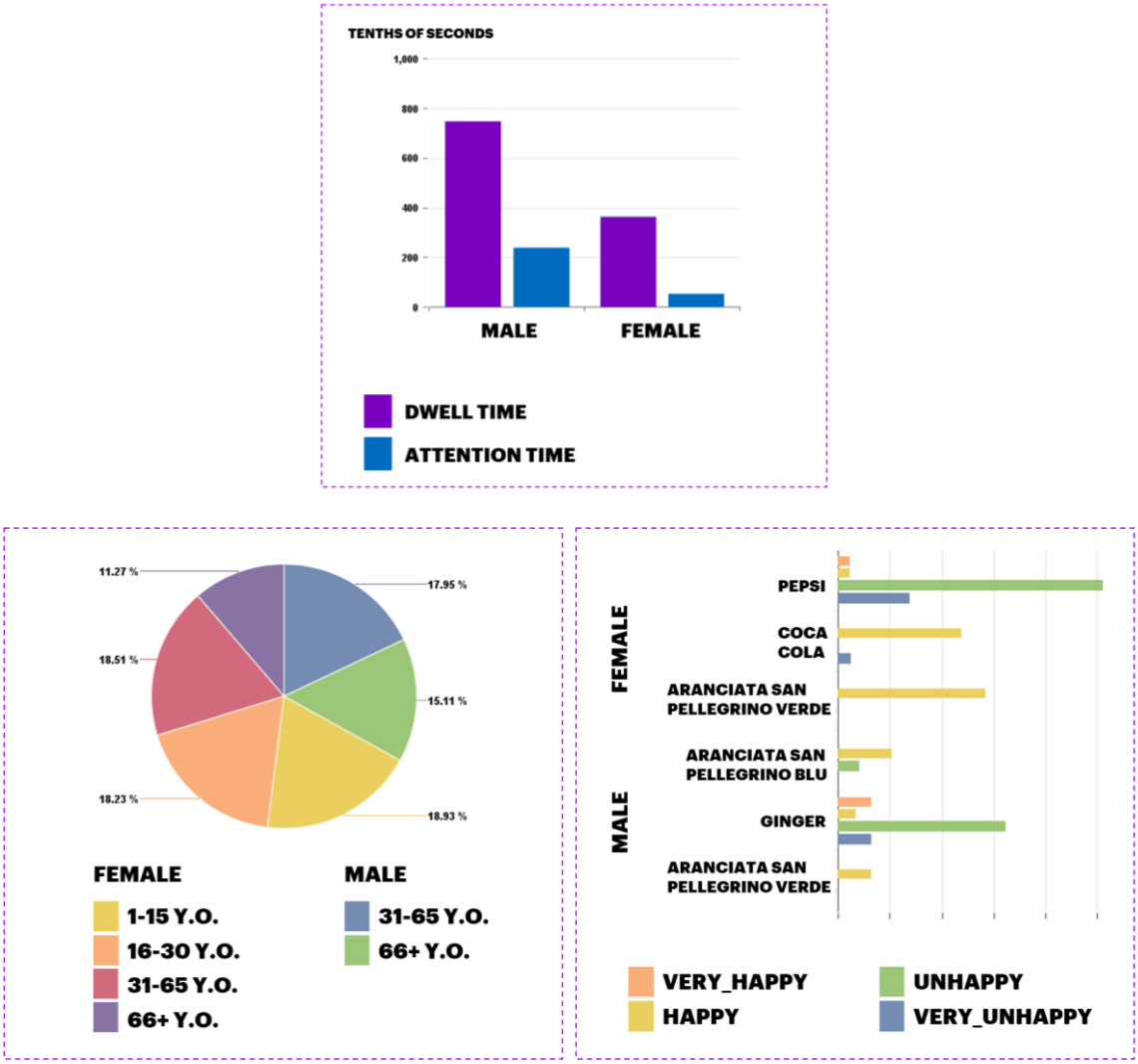


Figure 79. Insights Dashboard Examples

From the first graph, which monitors the time spent by a customer in front of a shelf paying attention and non, it is easily possible to understand that female individuals tend to pay less attention to shelves and products. This insight could be useful in the product packaging creation phase or in a in-store promotion creation phase: for female product, the packaging or the advertising should be more impactful in order to collect the attentions of female customers.

From the second graph, which monitor the distribution of age of customer interacting with a single product it is possible to notice that young males are not interested (are they the target of that product? If yes, there is a problem!), while for female individuals there is a homogeneous distribution.

The third graph shows the mood of individuals during the interaction with some products stocked in a shelf. One insight could be that female interacting with Pepsi and male interacting with Ginger are for the unhappiest, while females interacting with Coca

Cola and Aranciata Verde seem to be happy. Companies should deepen the reasons below the dissatisfaction of customer during the interaction with their product and possibly set up a marketing campaign with the objective of changing the perception individuals have about their product.

From these three examples it is possible to notice how many information this solution provides and how beneficial could be for a company.

7.6 Link with everyday used tools

7.6.1 Cloud for Customer

The final step that must be carried out is to provide all the info to the business users (sales representatives, store(s) managers, area managers,). An example of the tool that is SAP Sales Cloud, showed in the following screenshot.

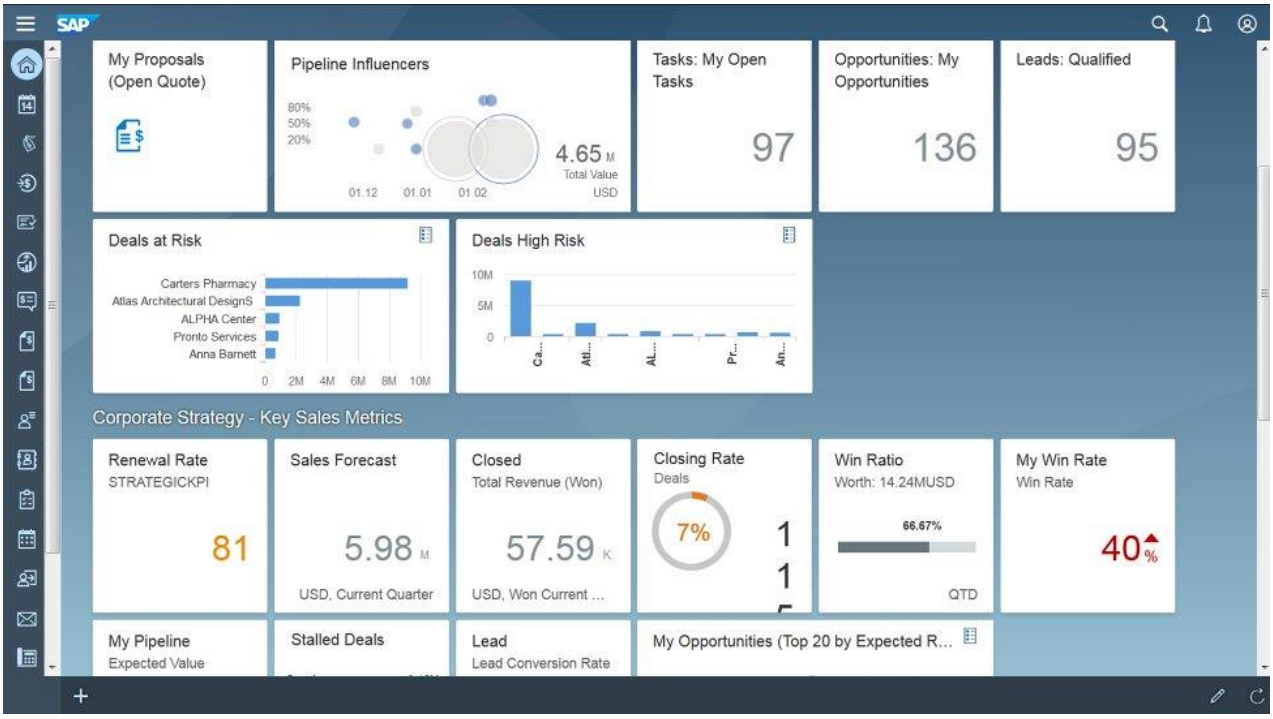


Figure 80. SAP Sales Cloud Home

As described in the dedicated section, Sales Cloud is the last generation CRM module provided by SAP. It supports the sales people in carrying out their activities as managing customer contacts, creating new visits, monitoring all the tickets created by customers and so on.

A possible scenario where this work-study can properly be applied in is the Perfect Store one.

7.6.2 Perfect Store scenario focus

The perfect store is a concept recently introduced that aims at obtaining a single measure reflecting how the physical store is performing based on different evaluation criteria.

A perfect store is a physical store that is compliant to a series of parameters and that could not almost perform in a better way (considering the standards at the beginning defined).

To enable Perfect Store scenario in Sales Cloud, a maximum score is set and the series of requirements the store needs to satisfy in order to be considered a Perfect one is then listed.

Once the business user accesses his profile and goes to the Store Visit page, the tool shows him the visit the user must carry out during the day.

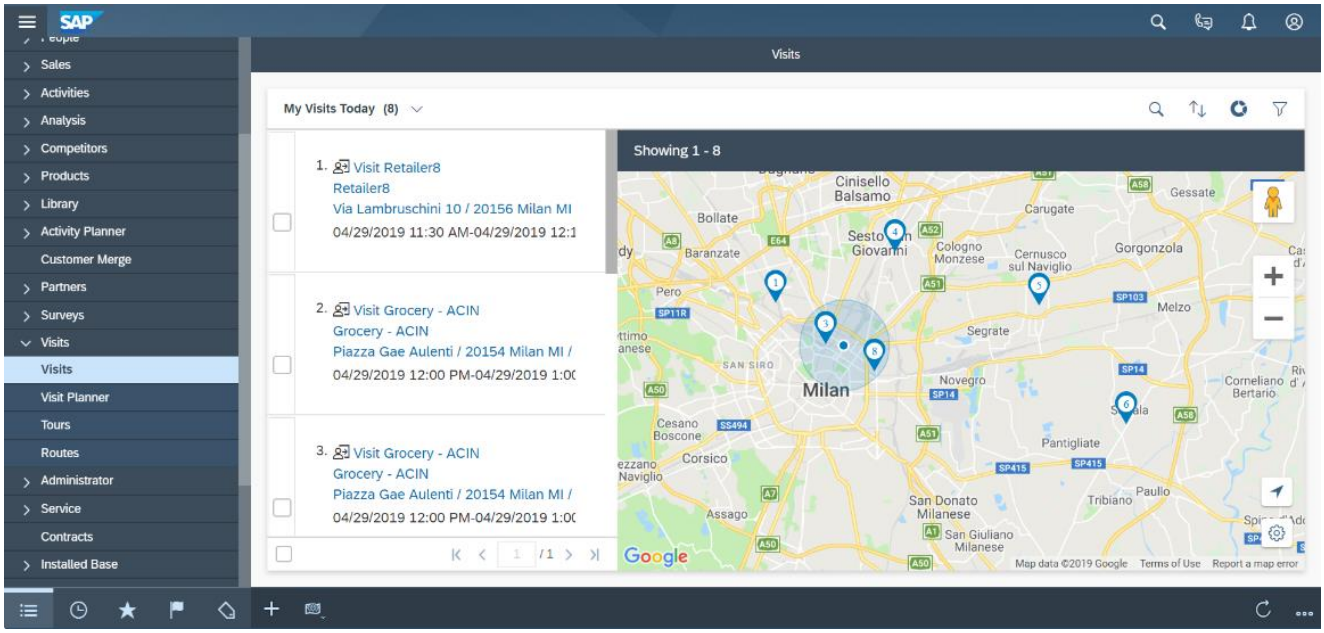


Figure 81. Sales Cloud Upcoming Visits View

Once the user enters a visit, he is supported by the interface along the process. A map of the visited store is displayed, and some Point of Interest are highlighted on it. A Point of Interest is a specific area in which the user has to carry out an action (this is a huge help for the user, since generally they have to visit a multitude of store and cannot remember each location).

For this reason, the Sales Representatives is guided in the store through a map of it, with some pins reminding where the points of interest are and consequently where he must carry out tasks (e.g. stock counts, price checks, displaying compliance checks, …).

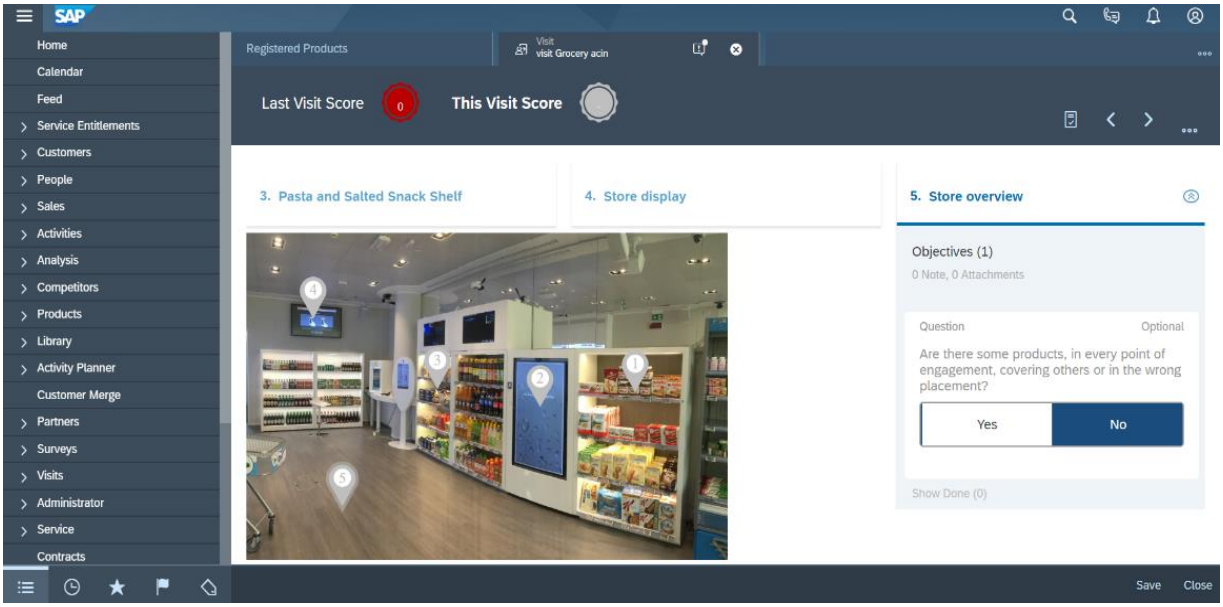


Figure 82. Perfect Store Overall View

Once all tasks have been carried out, the sales representative has the possibility to see how the store has performed. If the sum of points gathered is higher than the threshold defined, the store will be considered a Perfect One, otherwise, it is signal that too many aspects are not ok and there is the need of taking improving actions to match the thresholds expected.

Following an example of how points assignment of the store works.

Example

Consider a CPG company that wants to monitor how the stores in which its products are sold how they are performing. Let's say that a store is considered as Perfect when it reaches a score of 8 out of 10 points.

The satisfaction of all the requirements will result in a 10/10.

Let's say that 1 point out of 10 is given by the Price Compliancy of product XX. If the price of product XX exposed at shelf is compliant with the one established in the contract between CPG and retailer, the store will gain 1 point.

With the study carried out in this project-work there are the values assumed by the KPIs previously defined could be a requirement as well, assigning points to the store through more elaborated measures.

So, let's say that 2 points are given by the Target Coherence KPI. If it overcome this KPI threshold defined, 2 points will be assigned to the score of the store, otherwise no points will be assigned.

Being the threshold assigned to the value of 8, if the sum of the points gained by the store is greater or equal than this value, the store is perfect. Otherwise, this means that improving actions need to be carried out.

In the following image, the sales representative has ended the visit, and the score achieved by the store is displayed in green is positive, red if not. The interface displays also the last visit score, in order to have an immediate benchmark.

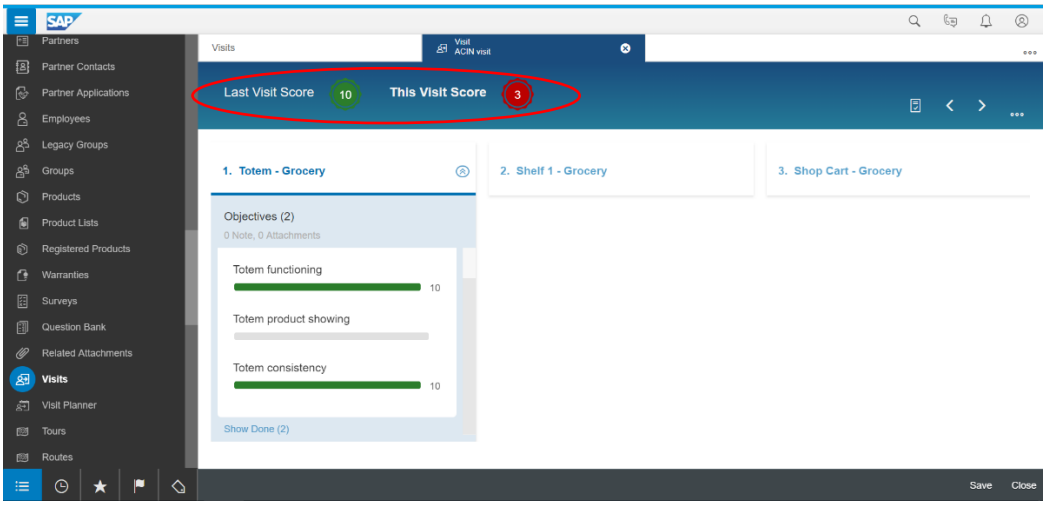


Figure 83. Perfect Store Score

The perfect store scenario is a clear example of how technologies are improving the daily activities of business users (i.e. sales representatives in this project). On one side, there

are new sensors are today available to collect real-time data to be processed to extract information and knowledge, on the other side the most important companies' IT systems are reacting to this opportunity, contemplating way to connect them to the IT architecture. Moreover, systems tend to be today offered in a modular way, in order to specifically cover the need of the company and to fit even in other system environment (e.g. some modules of SAP offering do perfectly fit in Salesforce environment).

The improvements go into two directions, both efficiency and effectiveness one. Still referring to Perfect Store scenario, think about the time saved by a sales rep in letting himself being guided by the interface, suggesting him where he has to carry out the defined activities, instead of lose time because of he does not remember where to go inside the store. Concerning the effectiveness, data are nothing without a good elaboration of it. A database needs to be well designed in order to be exploitable as much as possible in order to turn data into information. Finally, information must be communicated to company's people who can use them as an input to define and act improving actions and consequently achieve better performances.

The logical path of the data is showed in the following image, starting with a data engineering and ending with knowledge.

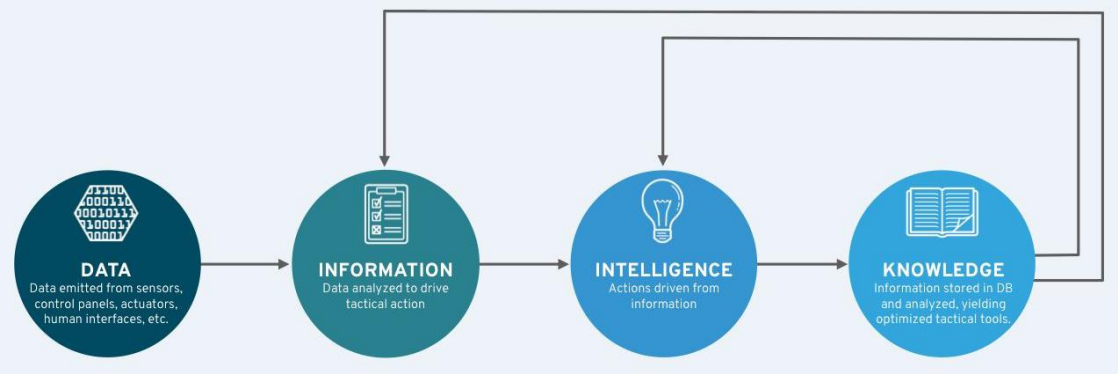


Figure 84. Data-Knwoledge Framework

This chapter represents the answer to the last research question "*Is there the possibility to design an end-to-end and ready-to-use solutions exploiting opportunities stemming from the adoption of Digital Technologies? "*

8. Solution's Benefits and Costs

8.1 Benefits

In the last part of the study of the solution, the effort has been focused toward the analysis of the benefits provided by the solution. Since it has been implemented in a highly particular context (an innovation center of a big consulting company), it is quite difficult to provide numbers and estimations, since there's not the possibility to deploy it in a real context. So, this last part of the work has to be considered as a qualitative one. Then, also a part concerning costs players has to face in the implementation of this solution has been studied.

The solution described aims at:

1) *gathering a series of data today not collected*
2) *transform them into relevant information business users could leverage on*
3) *make the information available for business users*

These three aspects of the solution generate multiple benefits. Following each of them is described:

- **Obtain customer insights**: today grocery shopping could be still considered as a black box; as shown in the KPIs chapter, today monitored KPIs are mostly the ones stemming from transactional data. All is known about the customer is obtained starting from purchases transaction. The installation of sensor registering data is key to know how single customer is behaving inside the store during the shopping process; these data, once aggregated, could be analyzed and relevant insights can be spotted. On them, business people could better drive their decisions and correct not effective ones.

  Consider, for example, a product whose target is made both by men and women. Analysis of data could provide the information that men are quite impulsive and stays in front of the shelf for a shorter period, while women tends to spend more time and think more about what to choose. This could be leveraged on thinking about different advertising action for men and women. Maybe a totem near the shelf could display different messages based on the gender of people in front of

it: longer time of message delivering for women, shorter and attention capturing for men

- **Product features improvements:** the solution allows to monitor the behavior of customers in front of shelf. Consequently, there is the possibility to understand how a product is performing.

  For example: consider a product picked up many times but just few of them it turns into a conversion. This could be motivated with a very attractive packaging (that convince people in picking up the product) but maybe very bad quality ingredients (that convince people in putting it back at shelf). So, customers decide not to buy it. This information can be exploited to understand that customer do not buy the product and taking corrective action → improve ingredients quality to increase sales and customer satisfaction.
- **Packaging appeal monitoring:** this is the opposite situation of the last example. Let's think, indeed, a product picked up very few times and maybe only after having picked up other products that, for a reason or another, did not convert. Why did the product have not been the first choice of the customer? How can my CPG company improve the packaging in order to attract customer and improve choice? These are all information that can be useful to improve packaging and convert into sales.
- **Driving marketing activities:** understanding what type of customers (profile) is the one who at the end goes shopping in store and buys the product and characteristics is crucial to understand how to deliver message and how to define marketing action. On the basis of this information, different kind of activities in store could be carried out. For example: if people who goes shopping and buy my product are millennials, my company could start an in-store initiative including the use of social-networks, while it could be difficult in case of older people.

  Another example could be the following: let's think about a product that fit the need of two profiles of people. Data highlights that only a type of profile is buying the product. This could show that the profile not buying is not aware and the not buying target does not see the product as addressing itself. This reasoning can

turn into an action, that is delivering advertising contents targeting the profile not converting.

- **Knowledge creation:** in the long term, there is the possibility of knowing the customers and how different actions influence performances. Have corrective actions been improving? Did everything work or not? Why did an improving action not perform as expected? The continue collection of information, implementation of corrective actions and study of results foster a virtuous circle of knowledge creation.
- **Sales representative work efficiency:** thanks to implementation of perfect store scenario, sales representative has the possibility of carry out his tasks in a guided way, optimizing his time. There no more time wasted in understanding what to do and where to do it (taking into account that a sales representative could visit multiple store with different layouts).
- **Sales representative work effectiveness:** in executing perfect store scenario and having view on the different KPIs chosen, sales representative has the possibility to immediately taking corrective actions that can improve performances.
- **Transforming data in easy interpretable measures:** the solution defined starts with the collection of a huge amount of data and transform them in a KPI simply interpretable by a person without technical experience.

8.2 Costs

As for the benefits, also defining quantitatively the costs related to the development and the implementation of the solution results quite difficult. Therefore, the following paragraph will present a qualitative view of the costs.

Starting from the assumption that the company which would like to implement the solution uses already SAP as the main provider of ERP solutions (so at least the SAP Cloud Platform and SAP Sales Cloud licenses are owned by the company itself) the main cost voices are the following:

1. Purchase of Hitachi ToF and Quividi licenses
2. Physical installation costs
3. Functional analysis costs

4. Coding costs

The first expense voice refers to the physical purchase of the tools needed for developing the solution. As with one Quividi license it is possible to manage many different locations (intended as different cams installed inside one retailer, for example), this voice would result for sure smaller than the one related to Hitachi ToF. As a matter of fact, with one ToF it is recommended to monitor one shelf, and this consequently leads to an important expenditure. It is important to highlight the fact that this solution could be implemented by two types of actor: Retailer and CPG companies. In the first case, a Retailer (e.g. a supermarket) could decide to integrate the solution in the whole shop and then sell all the data collected to CPG companies ("Solution as a Service"). In the second case, instead, it is admissible to think that only big companies (which occupies mono-brand shelves or isles) would be interested in implementing the solution to check performances of their products, without sensors registering data concerning other products.

For the physical installation costs, as the singular installation is not expensive, this cost voice results as a function of the number of sites in which the company who would like to implement the solution.

Functional costs refer to the ones related to the configuration of the two tools and of the shelves. Again, similarly to the first expense voice, Quividi software required few configurations and therefore this cost is surely lower than the one related to the configuration of the TOF. Actually, each laser has to be configured according to the different parameters shown previously in the Chapter 2. In addition, after the laser has been ready the shelves have to be mapped.

Coding costs refers to the expenses related to all the programming below the collection, the standardization and manipulation of raw data, the integration with the SAP Cloud Platform, the creation of the database and of the KPIs Measurement System and the final integration with SAP Sales Cloud. These expenses result quite important as they require an expert developer able to program in different languages and a SAP Sales Cloud expert for the final integration.

The main expenses voices are the former and the latter. In general, it is possible to notice that the more the number of sites in which the solution would be installed, the

more on the totality of the expenses the costs related to the purchasing of the tools would grow. On the contrary, if a company would decide to run a pilot, for sure coding costs would be the greatest voice on the totality. Managing the trade-off between these two costs will be crucial.

9. Conclusions

Thanks to the research and the work carried out for developing the solution described, it has been possible to provide evidence of how today the shopping process in Retail and in Grocery in particular is a black box; in fact, there is no adoption today of KPIs that highlight the performances of stores during the shopping process, and all the KPIs currently used by retailers and CPG companies stem from transactional data computations. This means that data adopted stem only from checkout transaction (i.e. sales, payments) and there is knowledge about what customers do and how they behave in the store.

In the scientific literature, most of documents taken into account focusing on KPIs topic refers to transactional ones. However, even if some attempts of measuring how different factors influence the behavior of customer are present, they have to be considered as experiments and not as something implementable in a big company context. In the non-scientific literature, emphasis of what are the upcoming technological trends has been overviewed, but no evidence of already implemented solution has been provided.

Even collaborating with Osservatorio Innovazione Digitale nel Retail of Politecnico di Milano, it emerged the evidence of a gap between theoretical study and concrete application of solution exploiting Digital Technologies to monitor new KPIs. Moreover, among different projects analyzed in Italy exploiting Digital Technologies, some front-end Digital Innovations have been implemented but no one is scaled on the entire network.

Information deriving by transactional data still remain essential but relying on those only could today consists in a limited approach. The way management of a company can influence performance measured by transactional KPIs lays in a limited span of actions. The possibility of exploiting opportunities given by the adoption of IoT sensors and other tools represent a way to get closer to the customer, understand what makes him happy and contrast pain generators. The better companies know the customer, the greater is the possibility to understand his needs, intercept them and correct the choices of the company in order to meet them as much as possible; being aware of the way they

behave inside the store lay the groundwork for developing insights and acting on them, through the definition of improving actions to get closer to what customer wants and reach the company goals.

After having studied some of the new today available technologies, it has been possible to design a new set of Innovative KPIs. One of the most important challenge of this era is to convert huge amount of data in simple and actionable measures, understandable even by people without technical experience. Strong effort has been dedicated to the study of the data sources and the way they collect the data of customers.

Then, transform data into information has been essential. The goal has been to start with a multitude of data to arrive at communicating effectively different KPIs in an easy way to business users.

The solution defined in this study is able to provide to management and sales people of Retail and CPG companies a tool to monitor effectively and efficiently the performances of the store during periodic visits. It allows sales representative to spot issues while carrying out visits and immediately think about corrective action to improve the performances.

The main advantages provided by the development of this Innovative KPIs Measurement System are 1) the creation of new KPIs uncovering how today customer behave in the store, giving the possibility to discover insights to leverage on, 2) the perfect fit of the solution with the tools already in use by the retailer and CPG companies employees to carry out its activities (*in this study only SAP offering products have been considered*).

As discussed in the costs part, it is not a plug and play solution, in the sense that it is needed a functional study to deploy the solution and customize it according to the characteristics of the company that wants to implement this system.

A company already using SAP suite has the possibility to implement the solution in a pilot almost with zero expenditure and then decide if implementing it or not. The solution is quite scalable and the diffusion of these technologies inside the different stores could be incremental (in the sense that quantity of sensors installed could be varied without facing constraints).

To conclude, this new Innovative KPIs Measurement System developed represents an end-to-end solution that allows companies to examine all those processes today not monitored, aiming at knowing customers, understanding them, carrying out corrective actions to create a virtuous cycle of performances improvement.

Bibliography

"The Internet of Things (IoT) in retail: Bridging supply and demand", Business Horizons, 2018, Felipe Caro, Ramin Sadr

"Do Digital Displays Enhance Sales? Role of Retail Format and Message Content", Journal of Retailing, 2015, Anne L. Roggeveena, Jens Nordfältb, Dhruv Grewal

"Happy grocery shopper: The creation of positive emotions through affective digital signage content", Technological Forecasting & Social Change, 2016, Marion Garaus, Udo Wagner, Sandra Manzinger

"A new approach to measuring retail promotion effectiveness: A case of store traffic", Journal of Business Research, 2016, Leonardo D. Epstein, Arturo A. Flores, Ronald C. Goodstein, Sandra J. Milberg

"The impact of digital transformation on the retailing value chain", International Journal of Research in Marketing, 2018, Werner Reinartz, Nico Wiegand, Monika Imschloss

"Improving retail efficiency through sensing technologies: A survey, Pattern Recognition Letters", 2016, M. Quintana, J.M. Menendez, F. Alvarez, J.P. Lopez

"A model to optimize rack layout in a retail store", European Journal of Operational Research, 2018, Corinne H. Mowrey, Pratik J. Parikh, Kevin R. Gue

"Investigating the effects of smart technology on customer dynamics and customer experience", Computers in Human Behavior, 2017, Pantea Foroudi, Suraksha Gupta, Uthayasankar Sivarajah, Amanda Broderick"

"A holistic approach for performance evaluation using quantitative and qualitative data: A food industry case study", Expert Systems with Applications, 2017, Gazi Murat Duman, Ozden Tozanli, Elif Kongar, Surendra M. Gupta

"Revisiting the supermarket in-store customer shopping experience", Journal of Retailing and Consumer Services, 2017

"Retail digitalization: Implications for physical stores", Journal of Retailing and Consumer Services, 201

"What is smart for retailing", Elseviere Inc., 2014, Eleonora Pantano, Harry Timmermans

"Perceived usefulness of innovative technology in retailing: Consumers' and retailers' point of view", Elseviere Inc., 2014, Sanda Renko, Mirna Druzijanic

"Mobile marketing: A literature review on its value for consumers and retailers", Elseviere Inc., 2013, Roger Ström, Martin Vendel, John Bredican

"Entertainment in retailing: The influences of advanced technologies", Elseviere Inc., 2010, Eleonora Pantano, Giuseppe Naccarato

"Innovation drivers in retail industry", Elseviere Inc., 2014, Eleonora Pantano

“The path-to-purchase is paved with digital opportunities: An inventory of shopper-oriented retail technologies”, Elseviere Inc., 2016, Kim Willems, Annelien Smolders, Malaika Brengman, Kris Luyten, Johannes Schöning

“Estimating Search Benefits from Path-Tracking Data: Measurement and Determinants Marketing Science”, 2017, Stephan Seiler, Fabio Pinna

“The Future of Retailing”, Journal of Retailing, 2017, Dhruv Grewal, Anne L. Roggeveen, Jens Nordfält

"Big data initiatives in retail environments: Linking service process perceptions to shopping outcomes", Springer Science, 2016, John A. Aloysius, Hartmut Hoehle, Soheil Goodarzi, Viswanath Venkatesh

"EMOMETRIC: An IOT Integrated Big Data Analytic System for Real Time Retail Customer’s Emotion Tracking and Analysis”, International Journal of Computational Intelligence Research, 2017, V. V. Satyanarayana Tallapragada, N. Ananda Rao, Satish Kanapala

"Customers’ tolerance for validation in omnichannel retail stores", The International Journal of Logistics Management, 2017, Hartmut Hoehle, John A. Aloysius, Frank Chan, Viswanath Venkatesh

"The effect of age, gender and education level on customer evaluations of retail furniture store atmospheric attributes", International Journal of Retail & Distribution Management, 2013, Kemal Yildirim, Kubulay Cagatay, Mehmet Lütfi Hidayetoğlu

"Customer experience quality and demographic variables (age, gender, education level, and family income) in retail stores, International Journal of Retail & Distribution Management, 2016, Pankaj Deshwal

"The effects of retail store characteristics on in-store leisure shopping experience", International Journal of Retail & Distribution Management, 2017, Amalia Triantafillidou, George Siomkos, Eirini Papafilippaki

"Measuring retail customer experience", International Journal of Retail & Distribution Management, 2013, Shilpa Bagdare, Rajnish Jain

"Perceptions and practices of innovation in retailing", International Journal of Retail & Distribution Management, 2015, Latchezar Hristov, Jonathan Reynolds

"In-store proximity marketing: experimenting with digital point-of-sales communication", International Journal of Retail & Distribution Management, 2017, Kim Willems, Malaika Brengman, Stephanie van de Sanden

"Retail store environment and customer experience: a paradigm", Journal of Fashion Marketing and Management, 2015, Ishita Sachdeva and Suhsma Goel

"The impact of retail store format on the satisfaction-loyalty link: An empirical investigation", Journal of Business Research, 2017, Omid Kamran-Disfania, Murali K. Mantralab, Alicia Izquierdo-Yustac,María Pilar Martínez-Ruiz

"Critical success factors of temporary retail activations: A multi-actorperspective", Journal of Retailing and Consumer Services, 2018, JenniferLowe, IsabellaMaggioni, SeanSands

"Understanding Customer Experience Management in Retailing", Elseviere Inc., 2015, Erna Andajani

"Introduction to the Special Issue: Information Technology in Retail: Toward Omnichannel Retailing", International Journal of Electronic Commerce, 2014, Wojciech Piotrowicz and Richard Cuthbertson

"Remodelling the retail store for better sales performance", International Journal of Retail & Distribution Management, 2018, Cleber da Costa Webber, (Faculdade Meridional, IMED Business School, Passo Fundo, Brazil), Jorge Oneide Sausen, (Faculdade Meridional, IMED Business School, Passo Fundo, Brazil) (Universidade Regional do Noroeste do Estado do Rio Grande do Sul, Ijui, Brazil), Kenny Basso, (Faculdade Meridional, IMED Business School, Passo Fundo, Brazil), Claudionor Guedes Laimer, (Faculdade Meridional, IMED Business School, Passo Fundo, Brazil)

"Store brands and retail grocery competition", Journal of Economics and Management Strategy, 2018, Rong Luo

"The Future Role of Digital Technologies In Emerging Technology-Based Retail Environments", U- and E-Service, Science and Technology, 2015, Stefano Sorace , Eleonora Pantano, Constantinos-Vasilios Priporas, Gianpaolo Iazzolino

"Vision (im)possible? The effects of in-store signage on customers' visual attention", Elseviere Inc., 2014, Tobias Otterbring, Erik Wastlund, Anders Gustafsson, poja Shams

"A REVIEW OF THE CONVERSION RATE IN MONITORING THE MARKETING PERFORMANCE OF RETAIL WINE SHOPS", Scientific Papers. Series B, Horticulture, 2014, Catalina Chivu, Arina Oana Antoce

"Fundamental patterns of in-store shopper behavior", Journal of Retailing and Consumer Services, 2017, Herb Sorensena, Svetlana Bogomolovaa, Katherine Andersona, Giang Trinha, Anne Sharpa, Rachel Kennedya, Bill Pagea, Malcolm Wright

"Developing a framework to improve virtual shopping in digital malls with intelligent self-service systems", Elseviere Inc., 2014, Haluk Demirkan, Jim Spohrer

"The New KPIs of Retail", Oracle,2019, Mark Lawrence

"Total Retail 2017", Pwc, 2017, Elena Cogliati, Erika Andreetti, Massimo Ferriani, Gianluca Meiardi

"Top 5 trends driving retail innovation", Retai Touchpoint, 2019, Bryan Wassel

"Top 5 trends for 2019 Retail Analytics", Tableau, 2018, Jeff Huckaby

"The store of the future. The place to be!", Osservatorio Innovazione digitale nel Retail, 2019, Valentina Pontiggia, Emilio Bellini, Valerio Portale

“Perspective on retail and consumer goods”, McKinsey&Company, 2019, "Peter Breuer, Tracy Francis,Jan Henrich, Greg Kelly, Sajal Kohli, Jörn Küpper, Clarisse Magnin, Paul McInerney, Tobias Wachinger"

"2019 Retail Trends Report", Microsoft, 2019, Microsoft

"Every Retailer Needs a KPI Strategy", JD Technology, 2018, JD Technology

"DIGITAL TRANSFORMATION", Engineering, Vittorio Aronica, Edward Abbiati, Francesco Bonfiglio, Giuseppe Idone, Chiara Ruffino,

“2019 RETAIL TRENDS REPORT”, Alliance Data, 2018

"PERVASIVE INTELLIGENCE: Accenture Consulting Retail Technology Vision 2018 Finding purpose for the digital age of retail", Accenture, 2018, Vish Ganapathy, Christopher Donnelly, Shyam Thyagaraj

“Painting the digital future of retail and consumer goods companies”, Accenture, 2017, Chris Donnelly, Oliver Wright

"TRANSFORMING MODERN RETAIL", Accenture, 2018, Jason Sain, Andrew Wong

“Retail Trends 2019”, CB Insights, 2018

"Connected Shoppers Report", Salesforce Research, 2016

"Global retail trends 2018 Global Consumer & Retail March", KPMG, 2018, Willy Kruh, Dan Coonan, Devika Devani

“Transform Retail Execution and Create the Perfect Store with SAP® Sales Cloud Deliver the Right Product at the Right Time, Place, and Price to Win at the Shelf Every Time”, SAP, 2018

SAP Hybris Cloud for Customer Admistrator Guide, 2017

https://www.sap.com

http://kpilibrary.com

https://www.vendhq.com

https://www.datapine.com

https://www.klipfolio.com

https://www.investopedia.com

https://trackmaven.com