Transforming personal finance thanks to artificial intelligence: myth or reality?

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ABSTRACT

Current societal challenges related to retirement planning, healthcare systems' evolution and environmental changes require households to pay a closer attention to their personal finances. This in turns calls for the associated industry to transform and scale. To do so, the personal finance industry could potentially leverage artificial intelligence tools for which there has been increasing levels of chatter. However, there is, to my knowledge, little consensus on whether or not those tools are appropriate given the challenges ahead. The literature review at the heart of this article first suggests that the stream of personal finance where transformation is more than needed is the one pertaining to investments, rather than the ones associated to loans, insurances or payments. Second, the productivity levers fueling the transformation of this branch are yet more driven, as of today, by simple digitalization notions rather by the usage of A.I. instruments. Over the next couple of years, more attention should thus be paid to use/business cases associated to investment products and the digitalization of their distribution chain.

KEYWORDS

Personal Finance; Wealth Management; Brokerage; Artificial Intelligence; Technological Change; Fintech; Financial Technology

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1. Introduction

There is an increasing interest in artificial intelligence [A.I.] and its applications in today's modern economy. This holds true both in the academia & the industry (see (Cao, 2020) for a recent academic review in the field of finance). However, the associated technologies are far from being fully mature. This is notably stressed by Gartner's "hype cycle" (Dedehayir & Steinert, 2016; Gartner, 2020; Linden & Fenn, 2003) , which has been, for two decades, one of the most respected framework when it comes to assessing and understanding the maturity of technologies. As seen in figure (1), most A.I. streams are still in their infancy and there is probably another decade before the associated technologies find their "product/market" fit.

At the same time, the field of personal/ household finance (loans, insurances, payments & investments) and the associated industry are in increasing demand. Modern societal challenges around healthcare, retirement planning & the environment indeed call, in a capitalistic society, for a higher level of financiarization at an individual level (Grable & Chatterjee, 2022). To support this change, the personal finance industry therefore needs to become more productive & leverage the currently available technologies to support households and individuals "at scale". This naturally raises the question:" can A.I. help with respect to this scaling challenge?"

To address this query, this paper will first brush a quick panorama, in section (2), of the personal finance industry and of the usage it makes of technology in order to fuel its transformation. This will be followed by a discussion on where lie, in my opinion, the current opportunities of transformation (i.e. where can technology help?) throughout section (3). A proposition on the upcoming role of A.I. in personal finance will then be articulated in sections (4) and (5).

2. How does financial technologies help transform personal finance?

Personal banking pertains to the way households manage their finances and leverage the associated ecosystem to meet their needs (Campbell, 2006; Collardi, 2012; Maude, 2010; Tilmes & Schaubach, 2006). Those needs have traditionally been articulated around four pillars or product categories: payment, loans, investments products & insurances. This has given birth to an industry structured around two core activities. On one hand, advisors and brokers distribute/sell financial products. On the other, asset managers, banks and insurers produce the associated services and process the associated orders.

Personal banking has, however, been the subject of recent critics as the associated services are not only considered expensive but also have not fundamentally changed over the past decades. For instance, investments products (e.g. private retirement plans based on equity) which yield, on average, a 5% return, have been subject to a 2-3% fee every year (Bazot, 2018; Philippon, 2016). As a result, for every $ invested, only 2 or 3 cents are earned by a household, which barely covers the inflation (currently running at a 1-2% rate in most mature countries). Those longstanding critics have thus given birth over the past decade to the Fintech movement (Philippon, 2022), an entrepreneurial stream aimed at leveraging automation technology (and notably artificial intelligence tools) to make personal banking more efficient. And of course, this entrepreneurial movement has had its academic counterpart (see (Knewtson & Rosenbaum, 2020) for a definition and (Takeda & Ito, 2021; Tepe, Geyikci, & Sancak, 2021) for recent reviews on the growth of the associated literature). The rise of the Fintech movement has notably been seen through the amount of capital invested in associated projects (Gai, Qiu, & Sun, 2018). Investments have indeed grown at a double digit (if not exponential) pace over the past couple of years (see figure (2)). Interestingly, investments are also heavily concentrated on personal finance initiatives (about 70% of the total investments).

Fintechs nowadays target both households and financial professionals. When it comes to households, the questions fintechs are trying to address are mainly one of speed. Recent evidence, for instance, shows that automation technologies have proven useful to reduce by about 30% the time it takes to get loans and insurances.

When it comes to professionals, fintechs have been aiming at providing tools to increase workers' productivity. This has been done by reviewing the value chain of professions (Grossman & Rossi-Hansberg, 2008) and automating as many activities as possible so that professionals can serve more households (Chatterjee & Grable, 2022a; Todd & Seay, 2020). Note that this should, in principle, also lead to a reduction in the price of the financial products/services.

3. Do we need more financial technology?

Looking at the current personal banking landscape (EBA, 2017; Navaretti, Calzolari, Mansilla-Fernandez, & Pozzolo, 2018; Vives, 2017), a lot has already been done over the past decades when it comes to loans and payment (Agarwal & Zhang, 2020; Berg, Fuster, & Puri, 2022). This can be easily understood as those instruments affects almost all individuals across their life-cycle (which also explains why most of the available funding has been dedicated to those segments (see figure 3)). When it comes to insurances, the market appears relatively stable and mature. This has been highlighted in the recent review of (Grable & Kruger, 2022) and is reflected in the relatively stable and low share (about 7 to 10%) of overall Fintech funding dedicated to this industry (see figure13). However, the use of technology has been rather limited when it comes to investments. Examples recorded in the literature mostly focus on the topic of robo-advisors, which consist in tools helping individuals to automatically allocate their investments in order to boost their returns. If efficient, those tools are not adopted in a wide fashion as their usage suffers not only from black-box considerations (Polansky, Chandler, & Mottola, 2019) & lack of trust (Cull, 2022; Mutual, 2017) (for instance, studies show that only 29% (resp. 53%) of baby boomers (Gen X/Y) trust robo-advisor) but also is not so frequent (most financial portfolios associated to investments are indeed only re-balanced once every year).

To understand why more technology dedicated to investment instruments may be needed, one must first look at the associated goals. Nowadays, capital is mainly accumulated by individuals through their working life to prepare for retirement (Ando & Modigliani, 1963). These results (through a combination of public pensions & annuities (or scheduled withdrawals)), as of today, in a replacement rate of about 60% (Blöndal & Scarpetta, 1999) of the wages one could earn while active in the labor market. Note that two additional uses cases (although relatively marginal) for capital investments at an individual level currently exist. Investments can first be used as a strategic instrument (Bernheim, Shleifer, & Summers, 1986) and alternative to long term care insurances (Cagetti, 2003). In this set up, families are incentivized to take care of the elderly (Dobrescu, 2015; Ribes, 2021), for instance, through bequests. Second, capital can be used in an altruistic fashion (Masson & Pestieau, 1997) as a mean to smooth consumption across generations via various inheritance mechanisms.

Now, looking at the current societal trends, notably across mature countries, personal investments & capitalization appear more than ever needed. In the context of ageing societies and a general reduction in fertility, public pension schemes, which now support most of the retirees, are seeing their efficiency being eroded (Fanti & Gori, 2012; Fanti et al., 2015). For example, the replacement rates provided by states are forecasted to shrink by 1 to 2 point a year (Ribes, 2022b) as a result of the growing share of older individuals (some scenarios point at a replacement rate moving from 60% in the 2020s to 30% in the 2050s). In its generic scenario, the O.E.C.D[1] forecasts a reduction of the replacement rate provided by public pensions for individuals entering the labor market in their 20s in 2020 from the currently observed 60% to 42% (OECD, 2021). This change is coupled with an increase in the average mandatory retirement age (from the current 64 to 66 - 67 by the 2060s). If states have also introduced across the O.E.C.D mandatory contributions to private retirement plans to start mitigating those effects, those mandatory contributions only increase the total replacement rate provided by public and mandatory pension schemes to 52%. Individuals therefore need to voluntarily reinforce their investments in private retirement plans

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[1] Organization for Economic Cooperation & Development.

to accumulate enough capital to generate a revenue stream representing the missing 8% of their current wage when they retire. Given that wages per individuals across the O.E.C.D average 46 -47k$ per year and that life expectancy at retirement is forecasted to be of about 20 to 23 years (depending on gender), individuals will need to save about 1k$ (or 2-3% of their yearly wage) every year as soon as they enter the labor market to generate an extra annuity of 3-4k$ per year (corresponding to the missing 8% in replacement rate not covered by mandatory public & private pension schemes) once they retire[2]. To navigate this change, information technologies are likely to be key. They will indeed be needed to nudge individuals into saving at the right time (i.e. as soon as they can) & at the right level as well as to reduce intermediation fees (and therefore enhancing the efficiency of the voluntary private capitalization scheme and the associated replacement rate)[3].

But funding one's retirement is not the only reason why more investments and more fintechs would be needed. The increasing life expectancy and the rising healthcare costs (Berchick, Hood, & Barnett, 2019), notably in the later stages of life (Shang & Goldman, 2008), require financial solutions to provide a decent quality of life to our elders (notably to preserve their purchasing power). Since healthcare costs have been seen to increase, on average, by 3 to 5% per year over the past decades (OCDE, 2022), building up precautionary savings will be crucial over the coming years. If the current coverage of public and mandatory healthcare schemes in place in the O.E.C.D remain stable (about 40% of pharmaceutical expenses and 20% of outpatients expenses are left as out of the pocket expenses for individuals), it can indeed be estimated that out of the pocket expenses (which now represents about 2% of the earnings of retired individuals) could triple over the next decades. If not mitigated, this could put a serious dent into the purchase power of retirees. If the voluntary use of investments products is for now rather limited and widely heterogeneous in a number of mature country[4], the aforementioned trends call for a large and quick democratization of those instruments.

4. How can artificial intelligence help?

Given the current trends highlighted in section (3), personal finance and notably the architecture and distribution of investments products would benefit from an acceleration. As per how artificial intelligence [A.I.][5] can help: there is no ready answer. As seen in recent reviews (Cao, 2020, 2022; Chatterjee & Grable, 2022b), A.I. is used in personal finance on a collection of specific use cases such as robo-advising for investments, credit scoring (lending industry), fraud detection (insurance) etc... Overall, the current academic consensus seems to be that if contributions are numerous, they have, when taken in isolation (i.e. one by one), a small impact at a societal level. Besides, contributions at this stage are more oriented towards enhancing the productivity of existing businesses by looking at their inherent value chain and finding automation opportunities that have enough volume to justify A.I investments (see (Milana & Ashta, 2021) for a recent discussion on the focus of A.I. in fintechs).

Now, as seen in section (3), there is a growing need for more technology to accelerate the distribution of investments products, notably to help households prepare for retirement & to help them cover increasing levels of healthcare expenses. Looking at the standard paradigm used to analyze where technology can help (i.e. the value chain decomposition of (Grossman & Rossi-Hansberg, 2008)), it appears that the distribution of financial investments products is articulated around four main steps (Maude, 2010). First, individual contacts (generally representatives of entire households) are garnered and qualified (e.g. level of revenue, financial objectives etc...).

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[2] Assuming a net return (post intermediation fees) on capital markets of 3%.
[3] Note that reducing intermediation fees by 1% could indeed translate in boosting the replacement rate provided by private pensions by 2%.
[4] The percentage of the population which currently has a private retirement plan varies from 0% to 40% across the O.E.C.D (OECD, 2021).
[5] Defined as a set of automation tools.

Based on this qualification, pre-sales activities then occur to match households needs with one or two products based on both financial & fiscal considerations. If interested, they are then invited to subscribe to a product. Finally, post subscription, households embark on a cycle of yearly reviews with their financial advisor.

Here, A.I. could help in several ways. First, the qualification of contacts could be accelerated (see (Fitz & Romero, 2021) for a rapid description of the generic techniques used nowadays in the realm of finance). For instance, classifiers could be trained to predict which household may benefit from financial advice based on multiple and sparse information sources. Second, pre-sales activities could also be improved. For instance, time series analysis could be of use to help individuals better plan for the future and to help households find the right level of savings and investments supporting their needs. This is also potentially where virtual assistants (Yue, Au, Au, & Iu, 2023), powered by natural language processing [N.L.P] techniques (such as ChatGPT), could be used to improve households financial literacy (which is an important area of research & development in the realm of personal finance (Chatterjee & Grable, 2022b)) & inform financial decisions. Additionally, clustering methods could also be used to match individuals with the savings profile of their peers and thus accelerate investment decisions. Third, clients reviews may also be enhanced by leveraging predictive techniques (such as classifiers) to understand who may benefit from a review (which usually represents less than 10% of an advisor's portfolio). Financial advisors have indeed about 100 clients (Foerster, Linnainmaa, Melzer, & Previtero, 2017) in their rooster and loose in efficiency when they do not focus their efforts on selected clients.

Since most of the A.I. research dedicated to the topic of investment has been so far dedicated towards robo-advising &/or portfolio selection and management (Hentzen, Hoffmann, Dolan, & Pala, 2022)), more micro-economic research will certainly be burgeoning on this front. Two types of studies could be of use here. On one hand, theoretical macro-economic research investigating the impact of technology (and therefore A.I.) on the investment arm of the personal finance industry could be beneficial. This type of research could leverage modeling tools (such as mean field games (Lasry & Lions, 2007), evolutionary methods (Witt, 1993) or stochastic processes (Ross, 1995)...) to depict the competitive mechanisms associated to the production & distribution chains of the industry and then leverage state level data-sets to calibrate the proposed models and infer conclusions. On the other hand, micro-economic data-sets, stemming either from the private (e.g. from a private firm) or public side of the economy (e.g. household level surveys sponsored by public organizations), could be leveraged to perform empirical studies on the impact of A.I. methods. This could either be done through an impact analysis with regression techniques (e.g. using ordinary least squares to measure the adoption of a new technique) or by documenting the usage and calibration of A.I. tools (see (Ribes, 2022a) for an example).

5. Artificial intelligence: a panacea for the investment industry?

As seen above, artificial intelligence certainly has a role to play in the transformation of personal finance. But it is merely one of the numerous tools which will be needed to address the societal challenges sitting at the core of the industry: retirement preparation and old age management. An important element to consider is that savings capabilities (and therefore investments opportunities) differ not only from one country to another (Rocher, Stierle, et al., 2015) but also across income & age categories (Callen & Thimann, 1997; Kessler, Perelman, & Pestieau, 1993). Income levels, age and economic uncertainty (measured for instance through the local unemployment rate), have indeed been shown, at country level, to explain about 70% of households' savings behavior (Hüfner & Koske, 2010; Rocher et al., 2015). Enabling households to invest and prepare for retirement therefore requires states to deploy heterogeneous and localized solutions. For example, the top households (income wise) can save up to 20% (if not more) of their income, whilst more than half of mature countries population[6] does not currently have the ability to

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[6] The households whose income is below the local median.

save and invest (see (Huggett & Ventura, 2000) for instance) thus putting their quality of life when retired at risk (see (Ibbotson, Xiong, Kreitler, Kreitler, & Chen, 2007) for a discussion on the savings rates required to ensure consistent living standards across income categories). This implies that, beyond questions of acceleration in the distribution of investment instruments, there is a complex societal problem to avoid a further polarization (income wise) of the society in the upcoming years. Note that polarization has already been fueled by the current macro-economic trends in terms of globalization (Goos, Manning, & Salomons, 2014; Oldenski, 2014) and automation (Acemoglu & Restrepo, 2022). Macro-economic studies will thus be required to assess how a mixture of additional public programs and highly differentiated reforms on the existing public pension and healthcare schemes can ensure decent living standards within entire populations (see (Ribes, 2022b) for an example).

But going back to the original topic of A.I., it must be noticed that the usage of those techniques is not limited to the investment industry. Let us take the example of loans. Their value chain can be divided into four segments: household acquisition, underwriting (i.e. household &/or individual credit risk scoring & application processing), financing & loan servicing (e.g. processing payments, replying to inquiries, dealing with non-performing loans and defaults...). Here a lot has already been done when it comes to underwriting and notably credit scoring (see (Eletter, Yaseen, & Elrefae, 2010; Opati, 2020) for examples and (Hentzen et al., 2022) for a recent review). However, as seen in the recent reviews of (Goodell, Kumar, Lim, & Pattnaik, 2021; Königstorfer & Thalmann, 2020) there are still opportunities for A.I. to accelerate the discovery of potential prospects for loans & to improve the way customers get serviced (notably to address non-performing loans and payments defaults).

The insurance side of the industry exhibits, on its end, a value chain which is similar to the ones of loans (acquiring, underwriting, servicing & financing). Here, there are three key areas of transformation where A.I. could be of use (Boobier, 2016). First, productivity could be improved when it comes to servicing, expressed in terms of claims management (by leveraging tools such as chat-bots for instance (Riikkinen, Saarijärvi, Sarlin, & Lähteenmäki, 2018)) and fraud detection (see (Dhieb, Ghazzai, Besbes, & Massoud, 2020) for an example). Second, A.I. could be used to bolster profitable growth though customer acquisition and retention (for instance through a higher degree of personalization (King, Timms, & Rubin, 2021; Singh & Chivukula, 2020) or by setting up churn prediction systems (Morik & Köpcke, 2004)). Finally, financing could be improved by leveraging larger datasets (for instance telematics) to price and provision insurance instruments more accurately (Balasubramanian, Libarikian, & McElhaney, 2018).

On the payment side of the industry, A.I. applications appear, to my knowledge, more limited. And given the permeability between the lending and payment industry, research directions highlighted in the literature seem to be more aligned with notions of credit scoring and fraud detection (Ryman-Tubb, Krause, & Garn, 2018). However, challenges expressed in terms of inclusion and anonymization (Matthews, 2022) currently points towards future developments for which A.I. usage has not, to my knowledge, been discussed (but could certainly be envisioned).

In summary, A.I. cannot be considered as the panacea addressing all the underlying societal challenges of the investment industry and is certainly not a set of tools which usage is limited to the investment turf. A.I. applications to the lending, insurance and payment industry are however less likely to have a profound societal impact compared to what could potentially be envisioned in the investment industry.

6. Conclusion

Financial technology has already been playing a major role in transforming the personal finance industry. As seen in section (2), it has been, so far, instrumental in accelerating the distribution of loans and insurances. And when it to comes to payments, the current trends in terms of digitalization, sustained by the diffusion of "buy now pay later" concepts (which represents another form of credit or short term loan), have been actually strengthening the position of the lending industry.

In short, financial technology has mostly been used to date to help households smooth & de-risk their

consumption capacity over the short run. But there is still much to be done, as discussed in section (3), to help them over the long run, especially when it comes to societal challenges associated to retirement preparation and healthcare expenses coverage. This is where financial technology dedicated to the investment arm of the personal finance industry has a major role to play.

On this front, artificial intelligence tools & techniques will certainly be of use (see section (4)) for various examples). But given their specialized & targeted nature, as well as the length of their development cycle, it will probably take several years for those tools to have an impact at an aggregated level. Besides, A.I. contributions will be most likely developed as ways to improve the efficiency of the existing investment instruments' production and distribution chains (see section (5)). They are therefore unlikely to address topics of heterogeneous savings capabilities across income and age categories which are currently correlated with large differences in livings standards once retired. This means that the continuous transformation of the investment arm of the personal finance industry is unlikely to have a deep societal impact if the associated change is not coupled with public reforms.
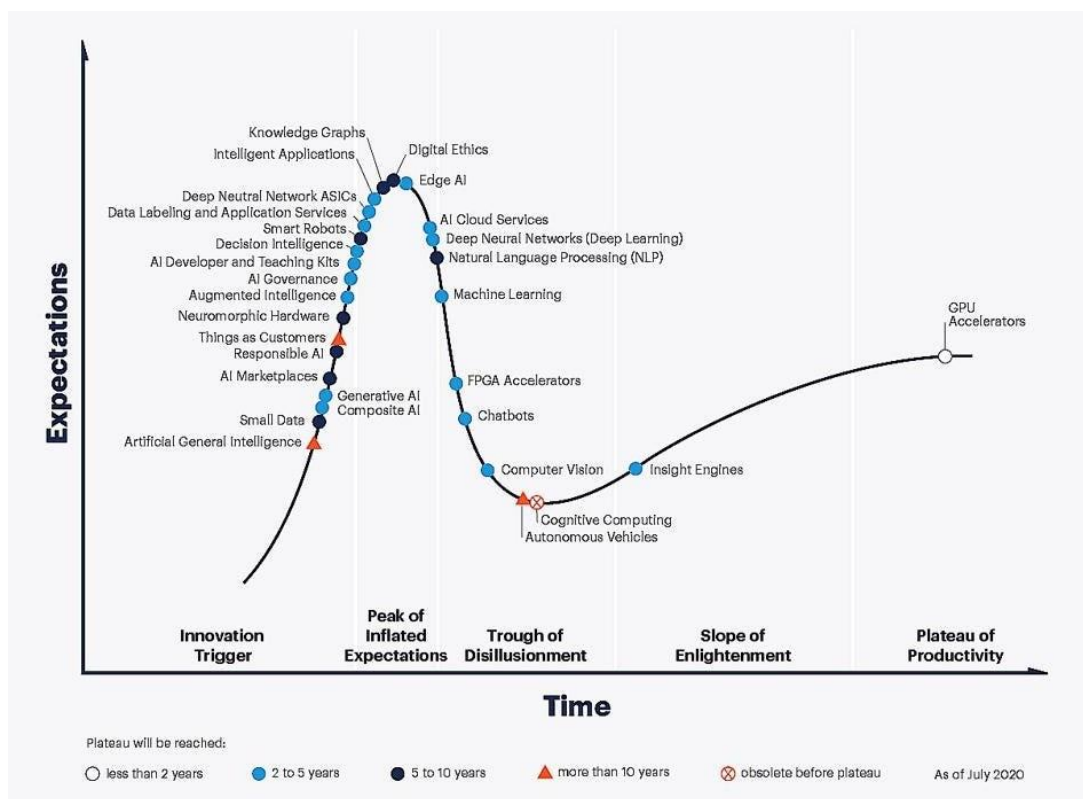
7. Appendix (incl. figures)

Figure 1. Artificial intelligence hype cycle.
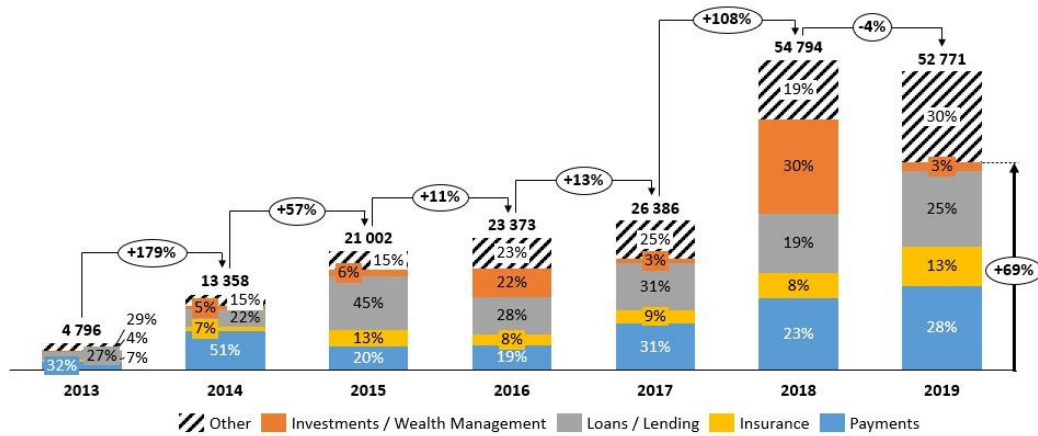
Source: Retrieved from (Gartner, 2020).

Figure 2. Worldwide estimated funding (USD M$) into Fintech initiatives.

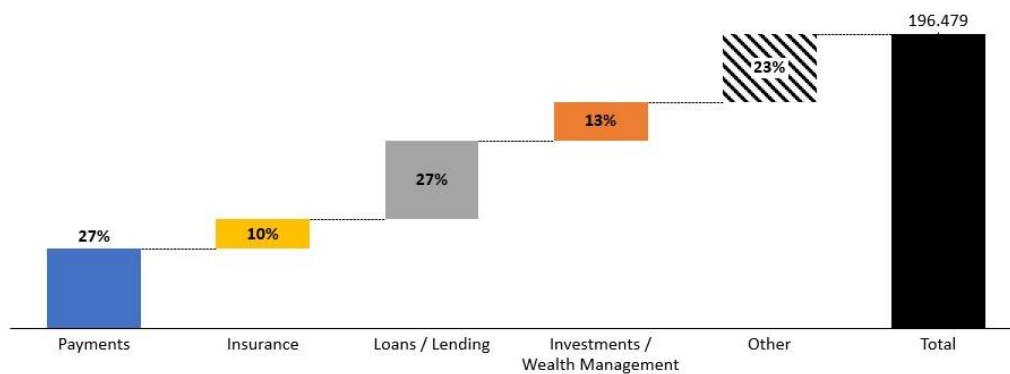*Source: Adapted from (Accenture, 2020).*

Figure 3. Worldwide funding (USD M$) repartition into Fintech initiatives between 2015 & 2020.

Source: Adapted from (Accenture, 2020).

Funding Statement

Declaration of Competing Interest

The author claims that the manuscript is completely original. The author also declares no conflict of interest.

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