REIMAGINING HEALTHCARE OPPORTUNITIES WITH ARTIFICIAL INTELLIGENCE

Abstract

Across the world, the healthcare industry is under tremendous pressure to meet the needs of patients who are no longer passive consumers but active participants; of physicians who are struggling to meet the needs of these patients; and of insurance providers that have to streamline payments and healthcare models to align with emerging healthcare delivery and financing models. In such challenging times, Artificial Intelligence (AI) can help the three key players collaborate more seamlessly and effectively to benefit each other. As an industry where adopting the latest technology is the norm, taking the AI route is more a natural progression of it.

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It's 2020.

James, an 87 year old war veteran, lives independently and enjoys his space. On his grandson's insistence, he uses an unobtrusive sensor-enabled Artificial Intelligence (AI) wearable that monitors his vitals and informs his family about his overall health. One day, James' wearable beeps and a health plan's virtual physician pops up as a chatbot on his smartphone, asking him if he's feeling dizzy, having blurred vision or experiencing shortness of breath, as it had recorded a blood pressure of 136/87. James answers "no" to all the questions.

The chatbot states that there's a possibility he was pre-hypertensive. It reassures him that his report had been shared with his grandson and an in-network healthcare facility that has a healthcare professional (HCP) on standby, to attend to him. While pre-hypertension is not really a cause for alarm in young people, it can be of significant importance for those in James' age group. The AI-based healthcare app determines this by looking through James' claims history, which indicates that he has already been hospitalized 3 times that year due to dizziness and shortness of breath.

James agrees to have the HCP look him up. Within minutes, the HCP arrives and accesses James' health information on an AI-enabled integrated electronic medical record (EMR) that recommends a precision drug based on his molecular profiling. In less than half an hour, the drug is delivered to James' doorstep. And in no time, his family arrives to visit him. 6 months later, his wearable sends him daily reminders to take the drug. It also records every intake of the drug, to ensure he is adhering with his prescription to stay healthy and prevent hypertension. Thanks to this AI-enabled system, James can enjoy his independent lifestyle.

AI Emerging as an All-Pervasive Force in Every Industry

The AI sector has witnessed rapid growth with the overall AI market predicted to reach US$16.06 billion in growth by 2022 at a CAGR of 62.9% between 2016 and 2022[1]. Even though 63% of users don't realize it[2], they are using AI almost every day – Amazon and Netflix recommendations and Google Maps real-time routing are just a few examples of it. This growth has been a result of an amalgamation of a number of factors like inexpensive parallel processing power, vast big data creation and rising competitive needs of businesses across multiple sectors that recognize the need for AI to augment their productivity.

AI, with its wide range of capabilities and application value, has rapidly emerged to make game-changing contributions to businesses beyond simple data processing algorithms, as a result of the significant advances in the technologies underlying AI. According to TechRadar's report, Artificial Intelligence Technologies Q1'17, natural language generation, swarm intelligence, speech recognition, virtual agents, machine learning platforms, AI-optimized

hardware and decision management are some of the AI technologies that have seen considerable innovations and success in the past couple of years (as shown in Figure 1).

However, it's not just these technologies that are seeing advancements. Deep learning, biometrics, semantic technology, image and video analysis, text analytics, natural language processing (NLP) and robotic process automation are also seeing growth. In fact, the NLP market is predicted to experience the fastest CAGR from 2016 to 2022, and deep learning technology market, the second fastest CAGR in the same period[3].
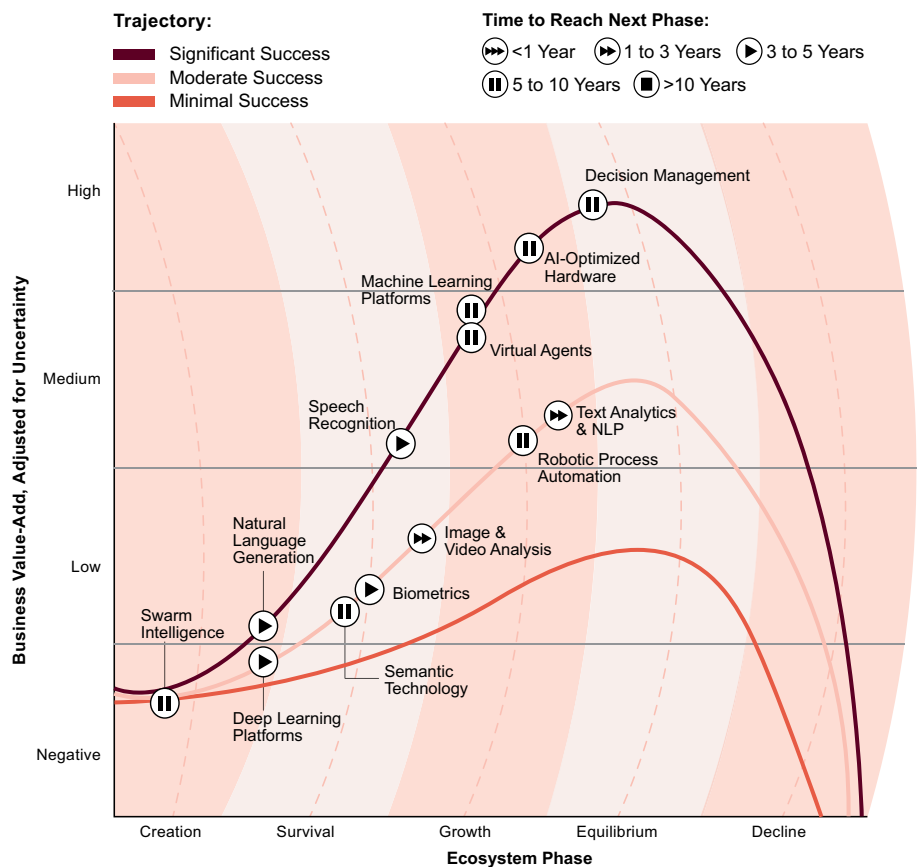

Figure 1: Artificial Intelligence Technologies, Q1 '17 (Source: TechRadar)

AI – Rising to Meet the Needs of the Healthcare Industry

Across the world, the healthcare industry is under tremendous pressure to meet the needs of **patients** who are no longer passive consumers but active participants; of **healthcare providers** who are struggling to meet the needs of these patients; and of **insurance providers** that have to streamline payments and healthcare models to align with emerging healthcare delivery and financing models. In such challenging times, AI can be integrated into the system to help the three key players collaborate more seamlessly and effectively to benefit each other. As an industry where adopting the latest technology is the norm, taking the AI route is more a natural progression of it.

"The only way to solve the supply-and-demand issues so many health services face is to leverage artificial intelligence or AI."
— Ali Parsa, Chief Executive of Babylon

Numerous other challenges, like an increasing demand for better and more effective treatments for chronic and long-term diseases that are compounded by the needs of an ageing population can be

managed better with AI-based solutions like virtual health assistants and deep learning algorithms accelerating accurate diagnosis, for the healthcare industry. Various studies have revealed that integrating AI as a decision support tool in treatments can result in excellent patient outcomes, and HCPs are likely to be more open to using it.

AI can also bring about a significant reduction in costs pertaining to diagnosis and treatments, which have been key market drivers. The AI healthcare market is proposed to witness a drastic growth, from US$667.1 million in 2016 to approximately US$8 billion by 2022, at a CAGR of 52.68%[4].

AI has great growth possibilities due to the fact that it has easy integration capabilities in the healthcare space. In fact, many healthcare organizations have entered this space with AI-based EMR because of which large amounts of data have been generated, analyzed and interpreted to offer accurate insights. Android and iOS device based applications that allow patients to manage their health more proactively, track their fitness

details and collaborate more effectively with healthcare providers to take better decisions are growing. While AI empowers patients with the information they need to take control of their health, it also delivers incredible value to healthcare companies across various business functions, which are at different stages in their AI adoption journey (as shown in Figure 2).

While the challenges in the healthcare industry provide ample impetus for the growth of AI, there are key opportunities that act as drivers, encouraging healthcare companies to adopt the technology and demand more effective tools. This subsequently pushes AI developers to experiment and innovate to bring in the next generation of AI-enabled solutions to healthcare providers. Technological advancements, a need for better patient engagement, demand for precision medicine and skyrocketing healthcare costs have been a few key AI growth drivers for the industry.
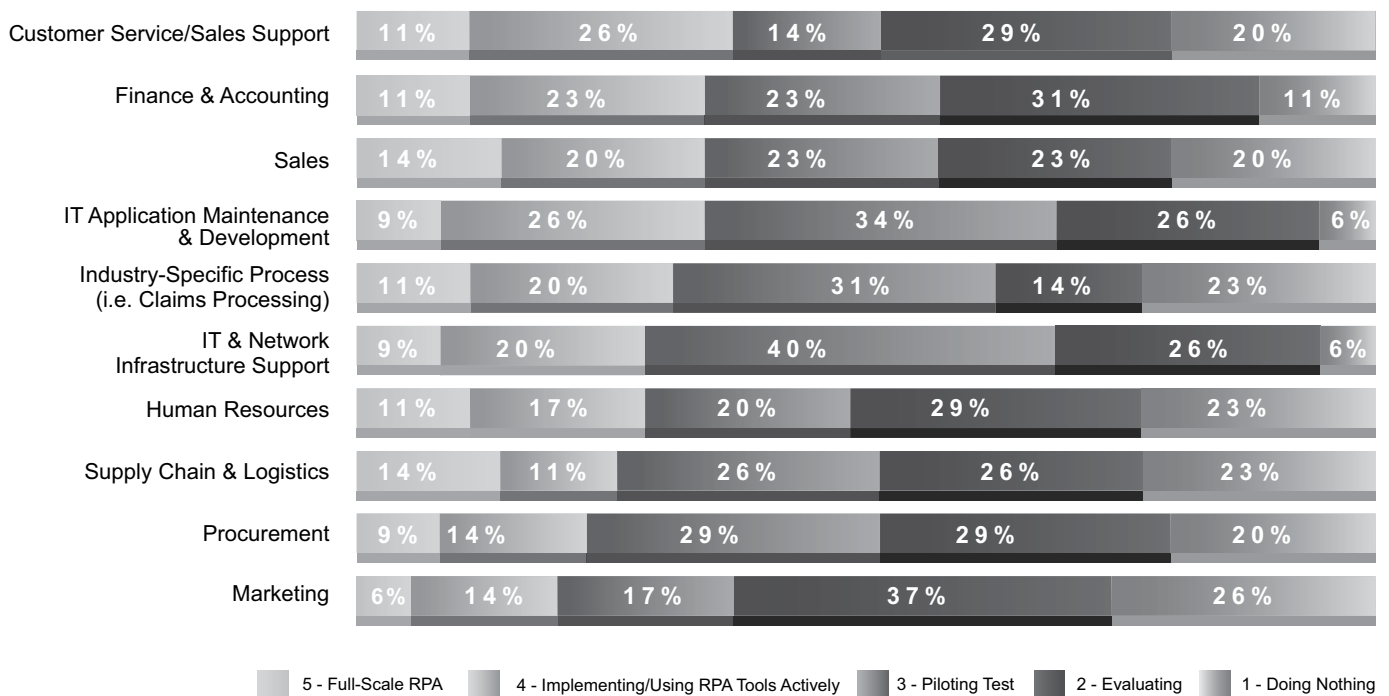

Figure 2: AI Adoption Stages of Healthcare Business Functions
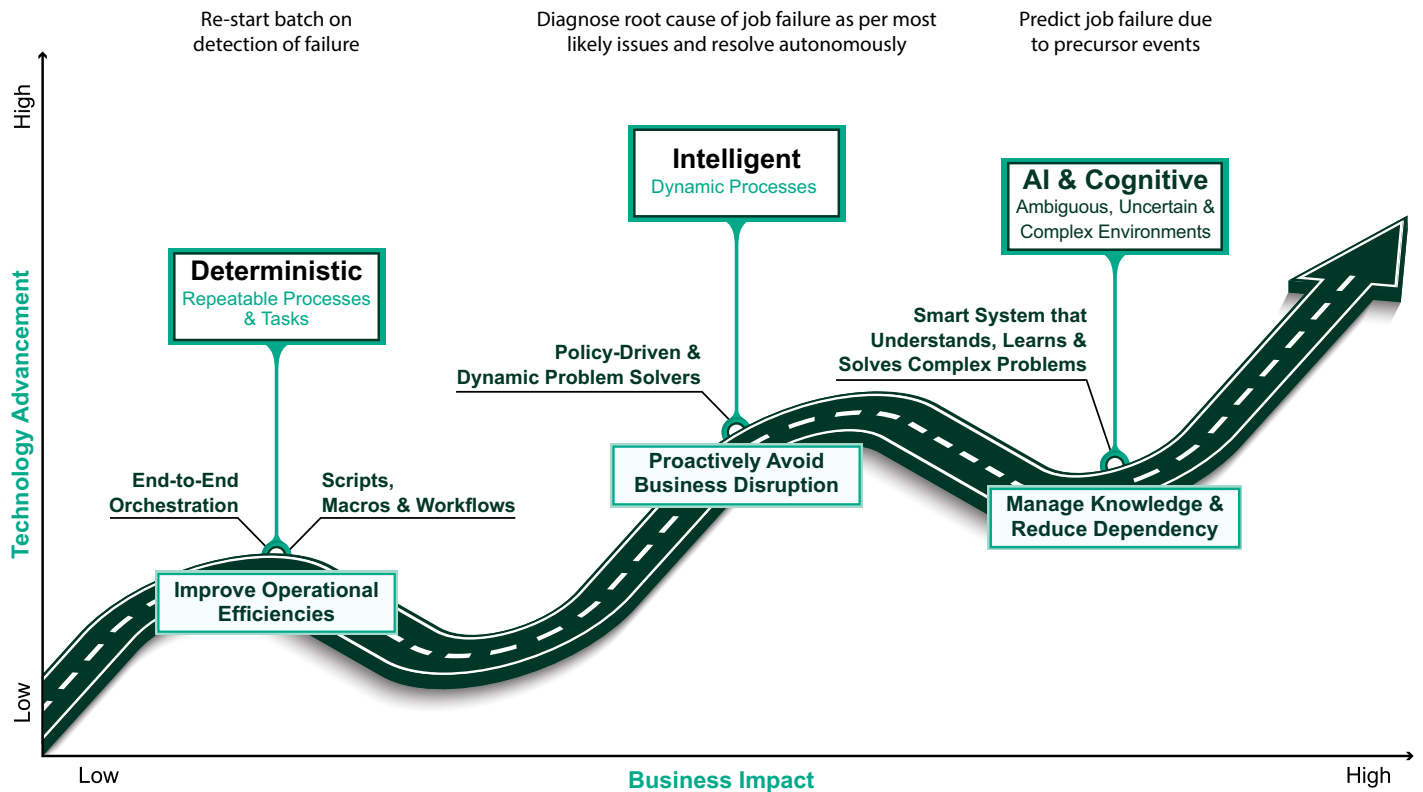
Adoption of AI has to be a Journey

Figure 3: AI Journey for Health Plans

The AI journey of a health plan should be gradual. It needs a step-wise approach from Operational to Predictive and Cognitive processes, to generate knowledge-driven insights as the organization attains a certain level of maturity in understanding AI processes and benefits, and the ability to handle the human aspects of organizational change (as shown in Figure 3).

In its **nascent stage**, typical AI use cases will be deterministic, and look at repetitive candidate processes, without very minimal or no human intervention. It can execute end-to-end orchestrations and use scripts, macros and workflows, to improve operational efficiencies. In the **deterministic stage**, AI should look at dynamic processes, with significant human intervention. AI algorithms at this stage will have the capability to leverage available data and predict a result or an outcome.

The final stage, which is the **cognitive or intelligent stage** is typically policy

driven, dynamic and focused on problem solving. This stage uses smart systems that understand, leverage and solve complex problems. It helps manage knowledge more efficiently and reduces dependency on human capabilities and legacy systems. The business impact of this stage is considerably higher than that of the first two.

Vital Applications of AI in Healthcare

Many health plans are compelled to embrace AI to address pressing industry imperatives. However, organizations have to look at the business value, technology maturity and automation potential of AI across the value chain to select the right business function (and use case) as a candidate for AI implementation.

Thanks to big data and new technological developments, AI is poised to bring incredible benefits to healthcare with its scope for widespread application.

AI has tremendous potential to bring transformation across the healthcare value chain – from product design, sales and quoting, enrolment and member management, billing, provider management, claims, medical management, and customer service, to analytics.

Product Design	Sales & Quoting	Enrollment & Member Management	Billing	Provider Management	Claims	Medical Management	Customer Service	Analytics
Risk Identification & Automation	Precision Marketing	Account Set Up	Premium Billing	Provider Credentialing	Claims Adjudication & Processing	Care Coordination & Care Plan Creation Management	Automate Customer Assistance (Voice Recognition + NLP)	Predictive Analytics to Improve Clinical Decision Making
Underwriting Logic	Broker Management	Eligibility Check	Prior Authorization	Provider Data Management	Claims Payments	Population Health Management	Insights-Driven Customer Grievances Management	State Reporting
Market Trend Analysis	New Business Quotes	Benefit Management	Premium Subsidy Processing	Contract Negotiations & Drafting	Complaints & Appeals	Creation of Treatment Plans	Correspondence Management	Federal Reporting
AV Calculation	Renewal Quotes	Member Segmentation & Retention	820 Processing	Provider Network Management	Referral Generation	Disease Management	IVR	
Product Rating	Channel Management	Renewals		Provider Outreach	Underwriting	Member Risk Assessment		
	Market Analysis	Patient Portals			Fraud & Abuse	Analyze Clinical & Financial Data		
					Overpayment Recovery Services			

AI Applicability Index
● High ● Medium ● Low

Figure 4: Potential AI Use Cases across the Healthcare Value Chain

We see a number of applications of AI in a health plan setting across the value chain. A few are:

Improving patient engagement models to enhance healthcare outcomes

The more a patient is engaged in healthcare, the more likely it will be that their health outcomes are better[5]. In fact, patients are quite keen to stay engaged in the process of decision-making about their health. Supporting this viewpoint is research that reveals that the greater a patient's engagement, the greater the likelihood that they will adopt preventive care approaches, decreasing the chances that they will have to get hospitalized or access emergency healthcare services, in comparison with patients who are less engaged[6].

AI Application: A study reveals that leveraging apps and online portals to facilitate existing communication between HCPs and patients can enhance engagement rates by 60% or more[7]. Healthcare apps that capture, store and share patient data over the cloud, allow patients and HCPs to access it anytime,

anywhere and have the potential to enhance patient health outcomes, believe 93% HCPs who were surveyed as part of an eClinicalWorks survey[7]. The next generation of these apps are AI-based medical consultation apps that allow patients to get information on (non-emergency) medical conditions.

Patients can input details about their health and symptoms. The AI-based app will check these details against a wide database of information on diseases by leveraging capabilities like speech recognition. In addition, it will take into consideration the patient's profile, previous medical reports and reactions to different drugs. Based on a comprehensive analysis of all these details, the app will recommend steps that the patient can take to alleviate the condition.

Some apps have also been integrated with the capability to follow up with the patient and provide reminders to take their medication. With almost 52% smartphone users already utilizing their devices to get health-related information[8], the outlook for acceptance of AI-based mhealth apps is quite bright. This is perhaps why the market is predicted to be worth $26 billion

by 2017, based on Research2Guidance's Mobile Health Market Report for 2013-2017[8].

Mining big data, EHR and EMR to design more effective healthcare services

In the healthcare industry, data (patient information, diagnosis details, new research findings, and more) is generated in large volumes every day. The integration of big data analytics tools have helped organizations gain the insights necessary to collaborate more effectively with patients and take better decisions, and this dependence on big data is growing. From aggregating patient data and storing it to reducing wastage; from cutting cost to streamlining hospital staff timings; from enabling remote patient monitoring to predicting epidemics, the application of big data has been growing extensively.

Electronic health records (EHRs) and EMRs are two such repositories of data in which nurses and HCPs aggregate patient-specific information. In 2015, nearly 87% office-based HCPs were using EHR-based systems[9]. However, the more extensive its use, the more HCPs are finding the

process of recording and accessing data time-consuming and cumbersome. They feel that the time they invest in data entry is actually time that they could have spent with patients.

AI Application[10, 11]: Integrating AI into this equation can eliminate the issue to a large extent. EHR and EMR systems with AI can give HCPs the ability to dictate their observations instead of manually adding the data. This will free them to attend to patients more closely and meaningfully. In EHRs and EMRs, AI gives HCPs the opportunity to delve into the existing data and to derive significant insights that they can refer to, for recommendations. AI can enable HCPs to leverage the information in EHRs and EMRs, transforming them from systems that record and store data to virtual assistants that can deliver value to HCPs.

"Electronic health records [are] like large quarries where there's lots of gold, and we're just beginning to mine them."

- Dr. Eric Horvitz, Managing Director of Microsoft Research, Specializing in Applying AI in Healthcare

With an AI-enabled EHR or EMR, HCPs can also get pop-ups notifying them about aspects they should consider when recommending a treatment plan or drug. For instance, if a drug is not suitable for a patient based on the patient's genetic profiling (as shown in the case of James), the AI system will be able to make a more relevant recommendation. Or, if a blockbuster drug being prescribed is likely to go out of production, it immediately fetches that information from the wide database that it has access to, and suggests a generic that may be as effective. Overall, it can be a smart aide that can help HCPs stay ahead of the curve.

Increasing efficiency of systems to manage rising healthcare costs

In 2016, healthcare costs rose to the highest in the past three decades, when the overall medical treatment price went up by 1%[12]. According to the director of USC's Schaeffer Center for Health Policy and Economics Health Policy, if this 1% is sustained over the course of a full year, the increase would be 12%, which is quite concerning for consumers[12]. Last year, a few health insurers stated that they would exit health insurance exchanges as people have been getting more expensive and unwell to treat[13]. This decreasing participation from insurers is raising additional concerns among patients and HCPs.

AI Application: By leveraging AI for clinical support, healthcare organizations will see an improvement in the process of medical imaging diagnosis. AI solutions can also be integrated in the ecosystem to improve healthcare delivery by streamlining hospital workflows. While this is not a comprehensive list of benefits that AI can provide, it has the scope to enhance healthcare outcomes by nearly 40% while reducing the cost of treatment by close to 50%[14]. Health insurance providers are typically keen to support HCPs who use new technology with the potential to improve healthcare outcomes. And AI can help HCPs achieve just that.

It can augment the HCPs' role and add a layer of decision support that can help them verify their diagnosis and treatment plans. AI can also play a crucial role in enabling them to accurately diagnose and treat patients who have chronic conditions, which according to the Agency for Healthcare Research and Quality makes up nearly 86% of the entire U.S. healthcare spends[15]. It can even prevent misdiagnosis, which happens in 10% to 20% of all the healthcare cases attended to[16].

Misdiagnosis, can have two-fold repercussions – one by potentially putting a patient's life at risk, and the other by costing the healthcare organization a significant amount of money – which can be avoided or even mitigated by leveraging AI-enabled systems. In fact, many mature AI-based healthcare chatbots, with which patients can consult instead of a physician, charge just a fraction of what they would otherwise end up paying for a consultation[17]. So, even if this is being paid for through health insurance, the insurer and patient end up benefitting.

Potential Use Cases across the Healthcare Value Chain

Overall, several health plans are exploring different AI technologies across various use cases. Some of the key AI elements being considered and in use are:

- **Natural language processing:** Clinical data analytics; predictive analytics; population health management and customer engagement.

- **Virtual personal assistants:** Customer engagements; IVR and call center; appointment scheduling; consumer health data analysis.

- **Autonomics:** Claims adjudication and bill payments.

- **Cognitive computing:** Provider network management; customer self-service; population health management; fraud, waste and abuse; clinical and decision support system and care management.

- **Machine learning:** Minimizing fraud; member engagement; improving patient outcomes and enhancing clinical efficiency; population health management and risk analysis.

- **Robotics process automation:** Claims payment; membership and enrolment and policy administration; underwriter support; customer support; billing, collections, recollections and reporting.

AI application benefits are evident in nearly every function and area of healthcare and in fact, even overlap a few. Take for instance the case of the AI assistant designed to remind patients to take their medicines on time. While it increases the chances that patients will adhere to their treatment plan, increasing the likelihood of their ailment getting cured, which in turn prevents their readmission, reducing the addition of one more consultation that

HCPs would otherwise have to attend to, it then goes on to ensuring that they are all in alignment with the value-based care mandate.

Whether through intelligent care management, medical upcoding or cognitive computing, AI has widespread application potential across the industry's value chain. Many of our clients have begun to understand the benefits of AI and are moving from a mobile-led transformation in the last decade to an AI-led transformation in the coming decade.

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