Orthopedic Prosthetic Market Analysis and Forecast Through Geographical and Product Segmentation (2017-2021)

By

Rajat Sehgal

Dissertation submitted for the partial fulfillment of the

MBA Pharmaceutical Management

Academic year, 2015-2017

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(WHO Collaborating Centre for District Health System Based on Primary Health Care)

IIHMR UNIVERSITY

TO WHOMSOEVER MAY CONCERN

This is to certify that Mr Rajat Sehgal of MBA Pharmaceutical Management from The IIHMR University, Jaipur has undergone internship training at Infiniti Research Marketing Solution Pvt.ltd, Bangalore from 30th January, 2017 to 1st May, 2017.

The Candidate has successfully carried out the study designated to him during internship training and his approach to the study has been sincere, scientific and analytical.

The Internship is in fulfillment of the course requirements.

I wish him all success in all his future endeavors.

(Col.) Dr.Ashok Kaushik

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Rajat Sehgal

In recognition of having successfully completed his
3 months of dissertation in the department of

Healthcare

and has successfully completed his Project on

Orthopedic Prosthetic Market Analysis and Forecast Through Geographical and Product Segmentation (2017-2021)

Date: 30th Jan 2017 - 1st May 2017

Organization: Infiniti Research Marketing Solutions India Pvt.Ltd

He comes across as a committed, sincere & diligent person who has a strong drive and zeal for learning

We wish him all the best for future endeavors

For Infiniti Research Marketing Solutions India Private Limited

M Faisal Ghaus

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CERTIFICATE BY SCHOLAR

This is to certify that the dissertation titled **"Orthopedic prosthetic market analysis and forecast through geographical and product segmentation (2017-2021)"** and submitted by Rajat Sehgal, Enrolment No 0043 under the supervision of **Mr Abhishek Dadhich** for award of MBA in Pharmaceutical Management of the University carried out during the period from 30th Jan 2017 to 1st May 2017 embodies my original work and has not formed the basis for the award of any degree, diploma associate ship, fellowship, titles in this or any other institute or other similar institution of higher learning.

Rajat Sehgal

THE IIHMR UNIVERSITY, JAIPUR

CERTIFICATE BY SCHOLAR

This is to certify that all ethical issues have been considered while collecting data for my dissertation titled, "Orthopedic Prosthetic Market Analysis and Forecast Through Geographical and Product Segmentation at Infiniti Research Marketing Solutions Pvt. Ltd, Bangalore."

Signature of student

PREFACE

In recent years the Indian Economy has been undergoing an important transition a shift from ownership to professional management. This project has been performed as a part of my dissertation in the second year of MBA.

This will also serve as basic knowledge in respect of **"Orthopedic prosthetic market analysis and forecast through geographical and product segmentation (2017-2021)"**as well as in department procedures and systems followed in the organization.

This project report covers various activities which involve in efficient use of orthopedic prosthetics devices after different amputation surgeries. It is accompanied with number of formats, charts and flow diagrams which will be helpful in understanding the subject matter.

I have put my endeavour to make the objective accomplished in the stipulated time. Despite all the limitations, obstacles, hurdles and hindrances I have toiled my hand to achieve the goal desired. Being a neophyte in the highly competitive world of business and in cooperate world, I have come across difficulties to make the objective a reality. Anyhow with the kind help and genuine interest formally supported by extreme support of my guide and college authorities, I am presenting this hand carved efforts.

ABSTRACT

BACKGROUND:

Orthopedic prosthetics is an artificial attachment which is used to replace a body part such as lower limb, knee, hip, hand, elbow, shoulder and parts of upper and lower extremity organs. Orthopedic prosthetics deals in manufacturing, design of custom fitted limbs which require low weight and high strength so that they can bear the weight of the body. A person may lose their body parts due to certain diseases such as diabetes, musculoskeletal disorder and due to road accidents, which require sudden amputation and artificial replacement of organs which provide movement to the body parts.

Limb prosthetics include lower and upper prosthetics:

Lower extremity prosthetics is used in different levels of amputations such as

- Knee disarticulation: It includes amputation below thigh level which occurs due to trauma cases or due to diabetes. It is then replaced by artificial microprocessor knees which helps in natural walking and provide stability to the knee.
- Trans-femoral amputation: In this the amputation is done above the knee which occurs due to sports injuries or due to trauma cases which is then replaced by artificial prosthetic devices.
- Hip disarticulation: It involves the removal of lower extremity and half of the pelvis region which is generally separated at the symphysis and sacroiliac pubic joints. It occurs due to some congenital disease or due to trauma cases.
- Syme's amputation: It is also known as ankle disarticulation in which the surgery is done and the person can put his weight on the bottom of the foot but a person cannot travel long distances. It is then replaced by artificial prosthetics which allows the person to walk easily.

Upper extremity prosthetics is also used in different levels of amputations such as

- Elbow disarticulation: It is the surgical separation of lower arm from the upper arm at the elbow joint. It is then replaced by artificial elbow which is then used for mobility

- Wrist disarticulation: It is a surgical procedure which includes the separation of wrist and hand from the arm and then it is replaced by artificial hand to provide mobility.
- Full hand prosthetics: It is a surgical procedure which occurs when a person lost his hand due to road accident and which leads to artificial replacement of hand. New technology devices are used such as Michelangelo hand which is used for natural movement.
- Partial finger prosthetics: It occurs when a person loses his finger due to trauma cases and is replaced by artificial finger which helps in doing normal work.

OBJECTIVES:

- To analyse the current & future market outlook of orthopedic prosthetic through various segment and region.
- To know the technological advancement in orthopedic prosthetics market.

RESEARCH METHODOLOGY

- **Study Design:** Descriptive and Exploratory study
- **Study Area:** Bangalore
- **Duration of study:** 30th January 2017 – 1st May 2017
- **Data collection procedure:**
  - **Primary research:** Data is collected through primary research with structure questionnaire. The research questions has been asked from industry experts, manufacturers and strategic decision makers.
  - **Secondary research:** Majorly, the data is collected through secondary research after reading articles, journals, literatures and internet.
- **Data analysis tools:** MS excel and SPSS

CONCLUSION

Prosthesis is an artificial device which is used to replace missing body part which may be lost due to disease, trauma cases such as road accidents and other congenital disorders. The global orthopedic prosthetic market is growing at a CAGR of 5.23% which is due to high prevalence of diabetes and rise in the number of trauma cases such as road accidents. Lower extremity prosthetics has dominated the prosthetics market as compared to upper extremity prosthetics which is due to high prevalence of diabetes which causes foot ulcers and requires

sudden amputation surgeries. Road accidents are also the major factors which mostly affect the lower body part as compared to upper body part. The availability of large number of advanced prosthetic devices for lower extremity was the major growth driver.

The market is highly competitive with the presence of large and small vendors. Some of the major players includes Ossur, Ottobock Healthcare, Endolite, Ohio Willow wood company and Blatch ford who has dominated the market with their advanced prosthetic products. The presence of other prominent vendors such as TAL Innovative Solutions, Fillauer, MTP Amputtee, Freedom Innovations compete with large vendors on price, quality and availability of products in the market.

ACKNOWLEDGEMENT

I hereby wish to take the opportunity to express my gratitude to **Mr Abhishek Dadhich, Assistant Professor, IIHMR University, Jaipur** for allowing to undertake my dissertation project on **"Orthopedic prosthetic market analysis and forecast through geographical and product segmentation (2017-2021)".**

I want to acknowledge the help provided by guide and friends. The precious inputs provided by them have helped in compiling this report. As well as I want to thank my friends and colleagues who helped me in this working.

I express my deep-hearted thanks and gratitude to all of those who helped me in this Project.

Contents

INTRODUCTION

Orthopedic prosthetics is an artificial attachment which is used to replace a body part such as lower limb, knee, hip, hand, elbow, shoulder and parts of upper and lower extremity organs. Orthopedic prosthetics deals in manufacturing, design of custom fitted limbs which require low weight and high strength so that they can bear the weight of the body. A person may lose their body parts due to certain diseases such as diabetes, musculoskeletal disorder and due to road accidents, which require sudden amputation and artificial replacement of organs which provide movement to the body parts.

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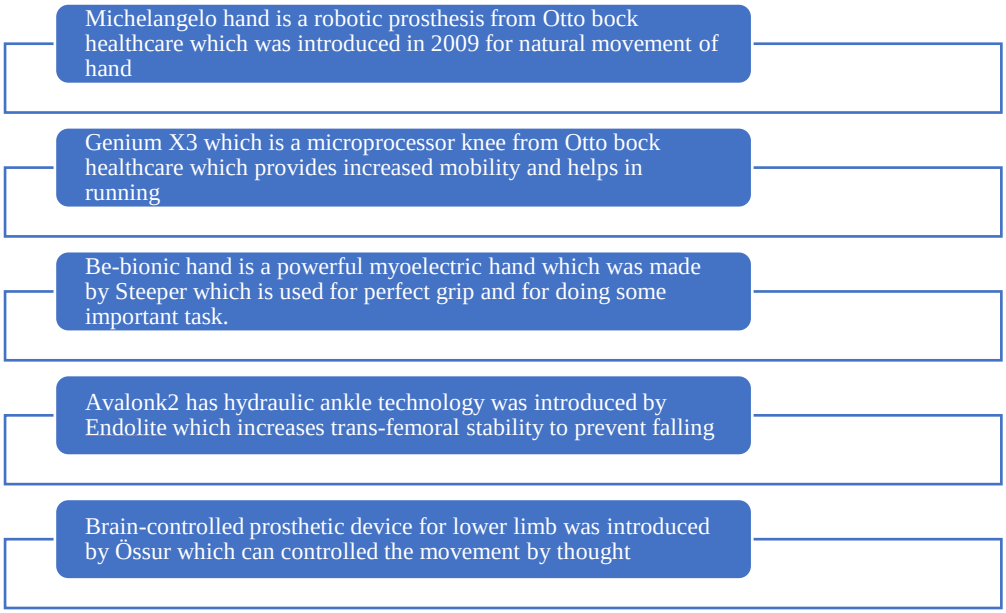
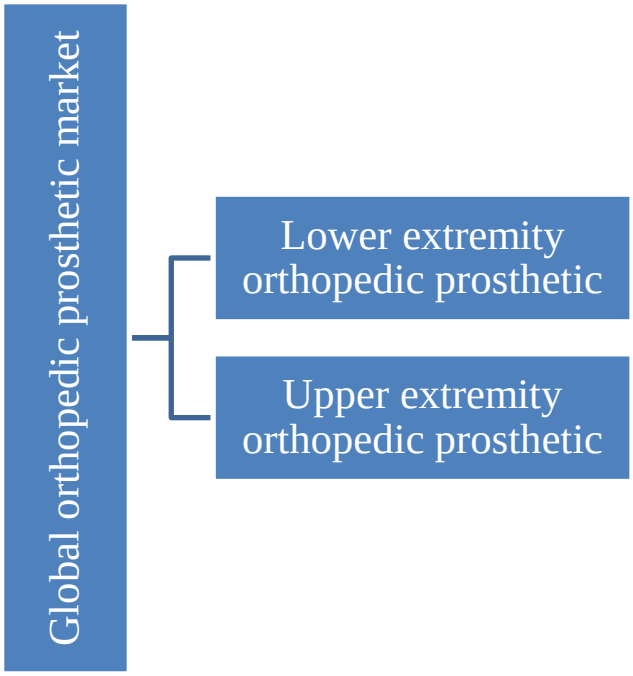
In Lower extremity cases, two types of prosthetics are used which include cable operated limbs which works by attaching a cable around the opposite shoulder of damaged hand and other is myoelectric arm which work by movement of upper arm.

Technological advancement in orthopaedic prosthetics



The major players in the orthopedic prosthetic devices include Blatchford, Fillauer, Össur, Ottobock Healthcare, and The Ohio willow wood Company which has dominated the market.

Market Segmentation by Product



Lower Extremity orthopedic Prosthetic Market

The lower extremity orthopedic prosthesis is used when an individual has underdone amputation of hemipelvectomy, hip articulation, above knee amputation, through knee amputation, below knee amputation, ankle disarticulation and partial foot amputation due to certain diseases or trauma cases. These lower body parts are then replaced by artificial prosthetics for the movement of lower extremities. Lower extremity prosthetics have the largest revenue of 85% in the global orthopedic prosthetics market owing to high lower amputation surgeries due to diabetes and road accidents. The lower extremity orthopedic prosthetic has favoured most of the amputees in providing comfortable and sufficiently strong prosthesis with aesthetic appearance. The increase R&D activities by vendors and research academics towards lower limb prosthetics are driving the product development and commercialization globally. For instance, Össur is investing more on R&D activities to develop innovative products. The company is actively engaged in developing mind-controlled Humonics solutions that helps individual to voluntarily move prosthetics. Also, the company launched more than eight prosthetics such as RHEO KNEE 3 and RHEO KNEE XC and product upgrades in 2016.

The increasing understanding of the biomechanics and mobility combined with clinical experiments has led to a significant growth in the development of limb prosthesis, especially in socket design. The sockets have maximum functionality as the movement in the prosthesis is emphasized by it. The advanced sockets include: elevated vacuum, flexible inner, and adjustable sockets with variety of adaptors available in the market.

Advanced lower extremity bionics prosthetic devices

- The Power Knee is a motored knee from Össur which provide strength and endurance to the user.
- The Symbionic leg from Össur which combine's the Rheo microprocessor knee and powered ankle to create a bionic leg.
- BiOM Ankle System from iWalk which is used to increase mobility and reduced stress from the body.
- The Proprio foot from Össur which provide mobility and stability to ankle.

Advanced lower extremity non-bionics prosthetics devices

- The C-leg from Otto bock which is a microprocessor controlled knee which is used in mobility.
- The Genium from Otto bock which is used for high activity amputees.
- The Rheo knee from Össur which helps in natural movement of the knee.
- The Orion knee from Endolite which is a microprocessor knee with advanced programming.

So, these are some new technological advancement in lower extremity prosthetics which lead to the growth of the market.

Upper extremity orthopedic prosthetic market

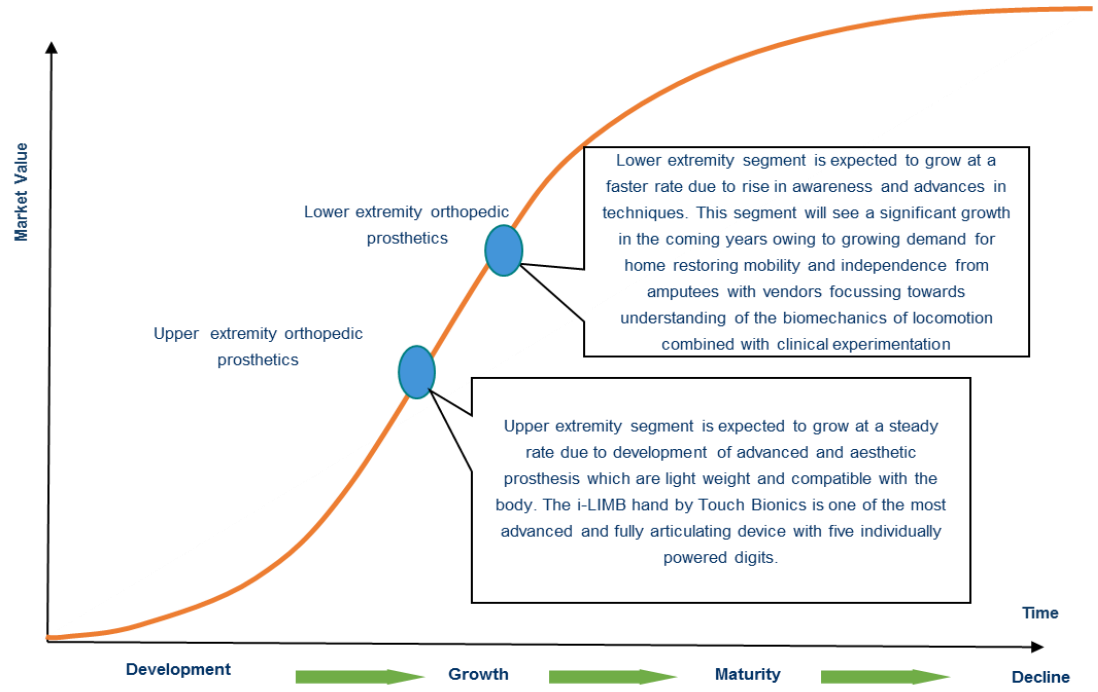
The upper extremity prosthesis is referred to artificial arm that requires to perform more functions in daily activities such as transport of objects held in hand. The energy required for operation of upper prosthesis is derived from the relative motion between the two parts of the body. There are different types of terminal devices such as hooks, sockets, and grippers that are used for upper limb prosthesis that have different types of functions. These are the devices which is used when an individual has underdone amputation of upper extremity such as shoulder, arm, forearm, wrist and hand which occurs due to sports injury or trauma cases. These upper body parts are then replaced by artificial prosthetics for the movement of upper extremities.

The upper limb prosthetics contributes to overcome daily routine problems caused due to limitation in the interfaces providing prosthetics to increase user satisfaction rates to reduce device abandonment. The upper limb prosthesis is classified into two cosmetic and functional that include both body-powered and externally powered. Most of the companies are focussing in offering body-powered upper limb prosthesis and upper extremity prosthetics products have less number of cases as compared to lower extremity prosthetics due to less prevalence of diseases and trauma cases.

Advanced upper extremity prosthetic devices

- The beBionic from steeper is a myoelectric prosthetic hand which helps for easy movement.
- The Boston digital arm system from liberating technologies which provide torque for the multiple task.

Market growth lifecycle for orthopedic prosthetic market 2016



Trends Driver and Challenges

Trends in Orthopedic Prosthetics

1) **Growing focus towards customised orthopaedic prosthetics devices:**

Customised prosthetic devices are fabrication of devices which are made as per the size and shape of a person's body part to provide appropriate body movement or to reduce the pain. Off late, vendors are focusing on developing customised prosthetic devices to cater to the growing demand from the individuals. As customized prosthetics offer superior level of functionality and are made as per patient requirements. The demand is high especially from athletes and accident victims. Some of the leading companies like Össur and The Ohio Willow Wood Company are offering a broad range of custom made prosthetics. For instance, Össur is focusing on providing intuitive mind controlled customized patient centric devices especially for osteoarthritis and injury solutions. Likewise, The Ohio Willow Wood Company is offering Alpha DESIGN Liners such as Alpha DESIGN BK and Alpha DESIGN AK liners which offer custom comfort and intimate fit prosthetics for amputees with uniquely-shaped residual limbs.

As the demand for such prosthetics is increasing, vendors are using in-house and third-party CAD/CAM technologies extensively used to help in the manufacturing of computer design limbs and parts which can perfectly match with the shape of the person's limb. In this technique, lasers are used which can read the shape of the person limb and transfer that information to computer through which the exact size and shape of the person can be known. It includes new techniques such as computer aided shape modification, 3-D scanners, 3-D printer integration and automated carver which helps to manufacture the limb which can be easily fit to the patient. For instance, Vorum Research is offering integrated CAD/CAM solution for developing customised orthopedic prosthetics. This integrated solution includes computer-aided shape modification software, 3D scanners, automated carvers, and 3D printer integration which helps in delivering custom fit prosthetics and increasing productivity by 600%. More than 700 providers of custom prosthetics are using the company's CAD/CAM solution. Thus, growing focus towards customised orthopedic prosthetics will encourage many vendors to develop such devices rather than off-the shelf prosthetics to cater to the growing demand among end-users. This will have a significant impact on the market growth of orthopedic prosthetics globally.

2) **Emergence of mind-controlled humonics solutions:**

Mind-controlled Humonics solutions are considered to be the future are for vendors to develop next generation orthopedic prosthetics. In the medical device industry, mind-controlled Humonics will be a remarkable clinical breakthrough and has the capacity to change the market dynamics of orthopedic prosthetics in the long-term. Humonics go beyond bionic devices and has the capability to fulfil the unmet needs of lost sensation, volitional control and development of human like aesthetics like gestures, which are lacking in current orthopedic prosthetics. Humonics with sensory feedback technologies will provide mind controlled user centric prosthetic devices that return the control to the prosthetic user. These devices with advanced technologies have the potential to change the life of a person who lost their body organs in trauma cases or due to certain diseases.

Össur is focussing on developing mind-controlled Humonics solutions which will help the patient to voluntary move their artificial limbs. The company's R&D department is working on developing next generation mind controlled orthopedic prosthetics. The company is actively involved in R&D activities to deliver cost effective medical

solutions in collaboration with leading scientists, healthcare professionals, and institutions to obtain clinical evidence and to verify product safety and efficacy before launch. In 2016, Össur partnered with Ottobock and established Research Trust Fund in the University of Iceland. This entity is offering grants and funding for research activities which focusses on mind controlled prosthetics and neuro-interface prosthetic control. Once the product is approved, it will have a positive impact on the market growth of orthopedic prosthetics globally.

3) **Technological innovations and product launches:**

Technological innovations coupled with rigorous R&D activities have led to the development of advanced prosthetic devices by vendors globally. Vendors are continuously involved in research and spent significant amount on R&D activities to launch innovative orthopedic prosthetics. In earlier prosthetic devices, monolithic materials were used which increases the weight of the devices but now vendors are using fibre composite materials during manufacturing of prosthetic devices. The usage of composite materials has reduced the weight of prosthetics and increased the compatibility with the body. The development of carbon fibre sports prosthetics allows end-users to actively participate in sports activities is one of the new advancement in orthopedic prosthetics. Also, vendors are using low temperature polyethylene terephthalate and polyetheretherketone in the manufacturing of low weight prosthetic devices and will benefit end-users to manage entire body weight by prosthetics.

Also, continuous focus on technological advancements has led to launch on innovative orthopedic prosthetics in 2016. For instance, Össur has launched eight prosthetics products such as Unloader Hip, Rebound Hip, and RHEO KNEE in 2016. The company launched two new versions of RHEO KNEE: RHEO KNEE 3 and RHEO KNEE XC, which are most versatile products within the RHEO product line. Also, Blatchford launched Orion3 within the Endolite range of lower limb prosthetics in December 2016 and Mini Blade for children in May 2016. Likewise, Ottobock Healthcare launched Prosedo and Pheon mechanical prosthetic knees in February 2017. Thus, technological innovations and product launches will have a positive impact on the market growth of orthopedic prosthetics globally.

Drivers in orthopedic prosthetics

1) **Growing number of birth defects, trauma cases and accidents cases:**

Globally, number of trauma, accidents and children with birth defects are increasing at an alarming rate. All these target population sometimes loss body parts such as elbow, limbs, foot, toe and other parts and require orthopedic prosthetics. As Per CDC report 2014, in the US, 236,000 people met with road accidents and admitted to emergency departments, out of which majority of people lose their body parts and 5,700 adults were killed. Around 22% of the lower extremity amputation surgeries are caused by road accidents which lead to rise in the number of surgeries and the major growth factor for prosthetics devices in the US.

Also, everywhere around 9,000 children undergo amputation surgeries due to lawn mower accidents in the US. Birth defects in new-borns require lifelong usage of orthopedic prosthetics. In Spain, as well, around 5,000 amputation surgeries occur due to accident and birth defects. Due to rise in number of trauma, accident cases and birth defects, the demand for orthopedic prosthetics is increasing in hospitals, prosthetics clinics and rehabilitation centres which provides treatment to the injured people or who have lost their body parts.

2) **Growing number of amputation surgeries and focus on restoring mobility among amputees:**

Amputation surgeries involving the removal of limbs by medical illness are increasing globally. Nowadays, aging population and life style diseases such as obesity, vascular diseases, and diabetes are the major reasons for amputation surgeries all over the world. The growing number of aging population brings an increase in the frequency of diabetes and vascular diseases. More than 65% of amputation surgeries are performed in people with above 50 years of age. Among all lifestyle diseases, type-2 diabetes and vascular diseases are the major reasons for amputation surgery which lead to loss of limb or toe. For instance, in the US, 85% of amputation surgeries are performed due to diabetes and vascular diseases. As per CDC report 2014, in the US, 29.1 million people have diabetes which is due to lifestyle changes and obesity problems. Approximately 185,000 amputation surgeries are performed annually in the US alone.

Also, in the UK, in 2015, Diabetes was the main reason for ambulatory surgeries which included 540 patients which undergone amputation surgeries of lower extremity per month. In the UK, 3.9 million people had diabetes out of which 90% of the people had type 2 diabetes. In 2014, 14,367 people lost part of their toe or their foot due to type 2 diabetes which resulted in the replacement of leg or part of their foot with the artificial prosthetics. Thus, rise in prevalence of chronic disorders such as diabetes and obesity is likely to increase in number of amputation surgeries.

The demand for restoring mobility and independence for amputees impacts the market positively and is encouraging manufacturers to address amputee issues and unmet needs by offering innovative orthopedic prosthetics. As the consumer base of amputees is increasing the demands for improvement in quality of life and innovation by vendors will improve the quality of life of amputees by restoring mobility and independence.

3) Availability of technically advanced prosthetics:

Earlier, a broad range of conventional lower extremity and upper extremity orthopedic prosthetics were available which works in conjunction with custom made sockets to achieve prosthetic fit. Nowadays, due to technological advancements, vendors are offering electric-powered and hybrid orthopedic prosthetics. New technologies, combination of technologies and new material usage will lead to the development of superior and improved prosthetics. Players such as Blatchford, Össur, Ottobock Healthcare, Fillauer, and The Ohio Willow Wood Company are focussing on new technologies and manufacturing prosthetics for all patient groups who are disabled and require prosthetics for support. For instance, Össur, one of the leading players in the market is offering innovative products such as Pro-Flex, New Form Fit, and Unloader Hip with ground-breaking technologies. Also, Ottobock Healthcare is offering body-powered prosthetics, pediatric prosthetics, and myoelectric prosthetics. The company is offering X3, which is the world's most technologically advanced microprocessor prosthetic leg developed in collaboration with the US military. The device is water-proof with automatic sleep mode option with superior battery life.

Blatchford is offering advanced microprocessor-controlled knees such as Orion3. The device has adaptive speed control, optimal stance release, and control stance support features. Also, vendors are using flexible polymers such as Kevlar, carbon fibre and titanium are used for reducing the weight of the devices and provide comfort to the

patients. For the manufacturing of prosthetics, vendors are using computer aided manufacturing (CAM) and computer aided design (CAD) to fabricate and design new models. Thus, availability of technically advanced orthopedic prosthetics will contribute to the market growth as more demand is created for such technically advanced and expensive products.

Challenges in orthopedic prosthetics

1) **High cost of orthopedic prosthetics:**

Though orthopedic prosthetics market is growing at a steady rate, high cost of prosthetic devices will hinder the market growth. High cost will keep a majority of target population especially in developing countries away from prosthetic devices as they cannot afford such expensive devices. Even a basic prosthetic leg costs around $10,000 and can go beyond $100,000 for more advanced prosthetic legs. Also, the cost varies depending on the level of amputation and type of leg. The average cost of an electric-powered orthopedic prosthetics is in the range of $40,000 to $60,000. At present, Genium X3 knee is considered to be the most expensive prosthetics with an estimated cost of around $120,000. Also, the price of upper extremity orthopedic prosthetics is in the range of $3,000 and $60,000. For instance, the price of Michelangelo electronic hand is around $60,000. Few companies are offering expensive prosthetics to select group of patients. For instance, Ottobock Healthcare has developed a bionic leg for the Australian Defence Force. The product is priced around $150,000 and is available only for military personnel.

After surgery, these devices require proper care and the patient also requires physical therapy which cost $50-$350 per session and the occupational therapy which cost $50-$400 per session which is the additional cost in the overall treatment. Thus, high cost of orthopedic prosthetics will have a negative impact and hampers the market growth orthopedic prosthetics globally.

2) **Risk and complications related to orthopedic prosthetics:**

Most of surgery or amputations have certain level of risks and complications which can affect the patient's life. Risks and complications after implanting orthopedic prosthetics arise depending on health condition, type of amputation and age of the patient. Once an

orthopedic prosthetics is fixed to a patient, infections near the target site is common and is a major complication to the patient if not treated properly with antibiotics. So, if there is any delay in treatment, in certain cases removal of artificial prosthetic is the only solution. After amputation of upper or lower extremity, bacterial and fungal infections are the major cause of complications. Also, unusual wear spots near stump region and chronic skin infections may occur in most patients and require proper care and awareness to avoid further complications.

Among early complications, problems with amputee stump may arise if surgeon does not analyse the length of patient stump before fixing orthopedic prosthetics. This stump calculation is important in children as growth in epiphyseal areas is high and will require accurate measurement of prosthetics. Children with growth potential must be checked and screened regularly as the prosthetic device implanted area tend to grow out of sockets. Also, stump bandaging is important and incorrect bandaging will lead to imbalance in stump contour and subsequent difficulty in fitting a prosthetic device. Sometimes during rehabilitation, pain progresses with exercise and decreases with rest is ischemic in nature. In those situations, consultation with surgeon is recommended to minimize future complications. Also, fracture alignment near joints should be considered to optimize stump, otherwise it may result in compromised joint and lead to short scarred stump with many disadvantages. The presence of peripheral neuropathy in amputee will influence manual dexterity required for implanting prosthetic limb for maintaining proper balance and posture. Thus, risks and complications associated with orthopedic prosthetics will have an adverse impact on the market growth.

3) **Insufficient reimbursement policies coupled with reimbursement denial by private insurance companies:**

The high cost of orthopedic prosthetics poses major challenge to the people who cannot afford prosthetic devices. Further, lack of reimbursement policies in developing countries and insufficient reimbursement policies in developed countries will hinder the growth prospects of orthopedic prosthetics market. Also, manufacturing companies are facing pressure from insurance providers as the latter reimbursement reductions due to which their pricing goes down and it will directly affect the revenue of the manufacturing companies. Advanced prosthetic devices are highly expensive due to which private insurance companies such as United Healthcare and Cigna denied

coverage to amputees. Some of the private insurance companies are giving only 20% reimbursement but the rest of the amount need to be paid by patients themselves which again adds to the overall financial burden. Some insurance companies are readily reimbursing for inactive people such as aged persons. However, they are putting restrictions or rejecting reimbursement for a growing child or an active amputee such as sports person. Also, many insurance companies are imposing low annual coverage for orthopedic prosthetics with restrictions on claim settlement amount which is very less and often not cover at least 40% of the total bill.

In countries, such as India and China, the situation is worse compared to developed countries and lack of reimbursement is a major challenge in these price sensitive markets. In spite of large diabetic population and large number of amputation cases in this region, people are still facing reimbursement issues. Though private insurance companies are giving reimbursement for orthopedic prosthetics, the coverage is very minimal and will not cover total treatment cost. So, insufficient reimbursement coverage and reimbursement denial by private insurance companies will have an adverse impact on the market growth of orthopedic prosthetics globally.

Geographical Overview of Orthopedic Prosthetic Market

Region	Market 2016	Market 2021
Americas 	In 2016, Americas is the leading region in the orthopaedic prosthetics device market. North America has the largest share which is due to the advanced technology. Rise in the prevalence of diabetes and trauma cases are the major factor for the amputation surgeries. The presence of the leading vendors in this region adds advantage to the market.	The advanced technology such as customised fibre prosthetics, robotic prosthetics, mind-controlled humonics solutions, be Bionics hand over traditional prosthetic devices will lead to growth of the market. Rise in road accidents and prevalence of diseases such as diabetes is the another factor which will lead to amputation surgeries in future.
EMEA 	Europe represents significant growth due to sports related injuries and road accidents. The advanced healthcare infrastructure and growing number of healthcare professional's in prosthetics was the major growth driver. The presence of key player such as Ossur, Otto bock healthcare, The Ohio Willow wood company, Blatchford ltd and Fillauer LLC has dominated the market.	By 2021, the share of orthopaedic prosthetics will grow at a steady growth rate and is expected to see significant growth in future with rise in amputation surgeries due to diabetes and road accidents. This will increase the demand of orthopaedics prosthetics in the market.
APAC 	APAC market is expected to grow fastest during the forecast period due to rise in the prevalence of diabetes and trauma cases which lead to amputation surgeries in this market. Advanced technology and rise in disposable income in India and China are the other growth factors in this region.	Emerging countries such as India and China are projected to become the most lucrative markets for orthopaedic prosthetics as most of the major vendors are shifting their manufacturing facilities in these region due to abundant resources and cheap labour. So, this will drive the market in future.

- **Orthopedic prosthetic market in Americas**

In 2016, orthopedic prosthetics market in the Americas accounted for a dominant share of and is expected to retain its dominant position over the coming years. The increase prevalence of diabetes and peripheral vascular diseases related to limbs and sports related injuries have contributed to the growth of the market. The growth is due to the advanced technology such as be Bionic hand, microprocessor knees, Michelangelo hand and due to rise in the road accidents which leads to loss of body part such as limbs, foot, toe and other body organ which is then replaced by artificial prosthetics. According to NIH report, In the US, 48 million people are above age 65 due to which the prevalence of diabetes is the major factor. As per CDC report 2014, in the US, 29.1 million people have diabetes which is due to lifestyle changes and obesity problem which lead to 1,35000 amputees in the US per year

North America contributes the largest market share for orthopedic prosthetic devices in 2016 which is due to the rise in the trauma cases and awareness among the people regarding prosthetic devices. 78% of the market share was captured by US in 2016 which is due to rise in amputation surgeries and sports related injuries. Lower extremity prosthetic devices have dominated the market in the US due to large amputation surgeries.

The presence of key players such as Össur, Ottobock Healthcare, The Ohio Willow Wood Company, Blatchford and Fillauer has dominated the market in Americas due to their advanced technology products such as Rhee knee, customised fibre products and robotic prosthetics. Other players such as Arm Dynamics and DARPA are also coming up with advanced orthopedic prosthetics to compete with the key players in the market. For instance, DARPA is working on brain-controlled devices which will revolutionise the global orthopedic prosthetics market in future.

- **Orthopedic prosthetic market in EMEA**

Orthopedic prosthetics market in Europe had a significant market share in 2016 which is due to the high prevalence of diseases and trauma cases in the region. Advance technology, rise in awareness among people regarding artificial prosthetic devices are the major growth factor. The major revenue contributors to this region were from most of the Western European countries such as the UK, France and Germany which is due to advanced healthcare structure and presence of key players in the market.

In the UK, 3.9 million people had diabetes out of which 90% of the people had type 2 diabetes. In 2015, 540 patients were treated with amputation surgeries of lower extremity per month which is due to type-2 diabetes. So, diabetes and obesity are the major factors which lead to the growth of the market in this region.

In African countries, high prevalence of diabetes, road accidents and civil war were the main reason for the limb loss which cater the growth of the orthopedic prosthetics market. Rise in the disposable income and awareness regarding prosthetic devices in sub-Saharan African countries are the other growth factors.

Developing countries in Europe such as Ukraine, Romania, Russia will have significant growth opportunities due to road accidents and rise in the amputation surgeries due to diabetes. The major companies such as Össur, Ottobock Healthcare, The Ohio Willow Wood Company, Blatchford and Fillauer has dominated the market but the other key vendors such as MTP Amputee, TAL Innovative Solutions, Freedom Innovations and other domestic vendors have significant market share in this region which lead to growth of orthopedic prosthetics market.

- **Orthopedic prosthetic market in APAC**

Orthopedic prosthetics market in APAC region is growing at a fast rate which is due to the large population in the countries such as India and China, due to which the high prevalence of diabetes and road accidents are the major factors for large amputation surgeries. In countries, such as India, China and Japan, Technological advancements such as robotic leg, be-Bionic Hand Hydraulic ankle technology and microprocessor knees and rise in the awareness among people regarding prosthetic devices are the major reasons for growth.

In India, 62 million people had diabetes out of which 7.1% are adults due to which 25% of the people develop foot ulcers, sores and other life-threatening infection in foot which is the major cause of amputation surgeries in India. Rising prevalence of sports injuries and rise in the disposable income in countries like India and China are the major factors for the growth due to which artificial limb replacement takes place. People are shifting more towards advanced healthcare which is due to rise in the disposable income, people spending on healthcare has increased.

Due high cost of orthopedic prosthetics devices, the companies are setting up their manufacturing facilities in these regions due to cheap labour and availability of land which will decrease the manufacturing cost for the companies and generate more profit to the major players and have low price to the end-user. The major players such as Össur, Ottobock Healthcare, The Ohio Willow Wood Company, Blatchford and Fillauer has dominated the market but the presence of other prominent vendors such TAL Innovative Solutions, ALIMCO, Endolite and other domestic vendors also have significant share which lead to growth in the orthopedic prosthetics market.

Orthopedic prosthetic market devices analysis in developed and emerging countries

Key Vendor Analysis

BLATCHFORD

The company is one of the world's leading rehabilitation providers in prosthetics, wheel chairs, orthotics and special seating. The company manufactures world's advanced microprocessor artificial limbs exclusively in the UK and International markets. The company is offering a broad range of sophisticated and successful orthopedic prosthetics such as Endolite and modular assembly prosthetics. It is providing exclusive clinical services to the National Health Service (NHS) and military. The company has corporate offices in 8 countries and presence in more than 35 countries. The company also has private prosthetic clinics worldwide. The company provides training to their clinicians so that they can have better knowledge in their field.

Key highlights:

- In December 2016, the company received new contract with the Defence Medical Rehabilitation Centre to provide Orthotic and Prosthetic rehabilitation services.
- In December 2016, the company's Microprocessor knees (MPK) got funding approval by the NHS and patients can get MPK through NHS Rehabilitation Centre.
- In September 2016, the company launched the latest microprocessor knee "Orion3" in the Endolite range of lower limb prosthetics.
- In June 2016, the company received the MacRobert Award for its Linx prosthetic limb from the Royal Academy of Engineering.
- In May 2016, the company announced new prosthetic blade " Mini Blade" for children.

Strength:

- The company offers a broad range of orthotics and prosthetics. It offers prosthetics portfolio under Endolite brand.
- The company has strong presence in the UK and in more than 35 countries. Also, it provides continued support for amputees through the company’s broad network of clinics.
- The company has strong R&D department and is coming up with new products with advanced technologies such as hydraulic ankle technology and microprocessor knees.

Strategy:

- The company focus to expand its business in emerging countries which will increase its revenue.
- The company has strong R&D department which focus on advanced and new products. The company’s strategy is to provide an integrated rehabilitation solutions to the patients that will have strong focus on prosthetics. It focuses on providing innovative orthopedic prosthetics, which are developed using bio-mimetic design principles.

Opportunity:

- The company is focusing on launching new orthopedic prosthetics with advance technologies. For instance, the company launched products such as Orion3 and Mini BladeXT in 2016.
- The company has vast presence in the UK and now seeking opportunities in the emerging countries to mark its presence.
- The company is actively partnering with government organizations such as the NHS and military department in the UK. These partnerships will help the company to stabilize its position in the market especially in the UK.

FILLAUER

The company manufactures, designs and customises the prosthetics and orthotics products locally and internationally. The company manufactures more than 3200 prosthetics and orthotics products for paediatrics to adult components. The company is known for their prosthetic suspension lock system. The company offers orthopedic prosthetics under two product categories: Upper extremity and lower extremity prosthetics. Its upper extremity products include NEXO system, Body powered system, Hands and gloves, Harnessing & Suspension, and recreational devices. Its lower extremity products include AllPro, Blaze, K2 Foot, Wave Comfort 2, MCV Foot Shell, absolute suspension sleeves, DuraShock, Torsion adapter, and other products. The company operates through many subsidiaries such as Fillauer Composites, Fillauer Orthotics and Prosthetics, Hosmer Dorrance, Motion control and the Centre for Orthotics Design globally.

Key highlights:

- March 01, 2014, the company received carlton fillauer prize for outstanding contribution to prosthetic science and practice.

Strength:

- The company has strong product portfolio with more than 3,200 products in prosthetics and orthotics for both pediatrics and adult patients.

- The company has its presence in the US, Europe and other international markets. Since its inception, the company emerged as one of the renowned leaders in the manufacturing, distribution, and marketing of prosthetic and orthotic products.
- The company manufactures products for both geriatric and paediatric patient group to serve them better with their advanced and innovative products.

Strategy:

- The company is focusing on expanding its product portfolio by launching high quality products to their end-users. For instance, its subsidiary Hosmer Dorrance is offering a broad range of upper and lower extremity prosthetics to meet the demand from its growing customer base.
- The company has its strong presence in the US and now focusing on expanding its operations in emerging markets. For instance, Fillauer Europe is helping the parent company to create broad customer base and product variety globally and is continuously bridging the parent company with international markets.

Opportunity:

- The company is focussing on emerging markets and are offering high quality products to maximize its revenue and share.
- The company focuses on new product development with advanced world-class prosthetic technologies. The company's subsidiary Motion Control is developing many advanced products such as U3 in which microprocessors control both hand and the elbow simultaneously.

OSSUR

Össur is the market leader in the global orthopedic prosthetics market which manufactures, develops and sells non- invasive orthopedic equipment such as bracing, support products, compression therapy and prosthetics. Its products include RHEO KNEE, Unloader Hip, Rebound Hip, Unloader one and Form Fit product lines. The company generated revenue of $521 million in FY2016. The prosthetic sales growth was 19% in 2016. The company has its presence in more than 20 countries. The company has acquired more than 15 companies. In 2016, the company has acquired Touch bionics and became the global leader in prosthetic devices. The company has its significant presence in Americas and EMEA with a largest market in prosthetics. The company is expanding its market in APAC region with advanced technology. The company is expanding its product portfolio with new and advanced products. Össur has strong R&D department which is focussing on mind controlled human solutions for next generation of prosthetics.

Key Highlights:

- In March 2017, the company partnered with International Cartilage Repair Society (ICRS) for first global Patient Registry
- In February 2017, Össur organised first orthotic fitter course which was hosted at Össur academy.
- In March 2017, the company organised hip osteoarthritis symposium.
- In October 2016, Össur prosthetic technologies dominated at world's first Cybathlon event happened in Switzerland

Strength:

- The company has strong R&D segment and currently working on advanced prosthetics devices
- The company offers full range of premium lower limb prosthetics including knees, feet, and liners as well as bionic upper limb prosthetics.
- The company operates in more than 20 countries across the globe with over 2800 employees.

- The company has strong financial strength and has acquired more than 15 companies and recently acquired touch bionics which is the leading company in prosthetics.

Strategy:

- The company always focuses on launching innovative products to remain competitive in the market. For instance, in 2016, the company launched around eight prosthetic products such as RHEO KNEE3 and XC, Unloader Hip, and Rebound Hip.
- The company is focussed towards strategic acquisitions, it has acquired more than 15 companies with diverse product portfolio and has wide network of sales channel. The company believes its significant growth opportunities in emerging countries like India and China to provide advanced technology products in many untapped geographies.

Opportunity:

- The company seeks to gain opportunities by diversifying their orthopedic prosthetics portfolio through M&A and are focusing to expand their presence worldwide. For instance, the company acquired Touch Bionics and Medi Prosthetics. These acquisitions have enabled the company to reach a broad range of end-users and helping in enhancing their quality of lives.
- The company focuses on expansion of its products by developing new technologies that improve the performance and usability of existing products to meet the growing needs of its customers. This creates opportunities overhead and increases the operating efficiencies to expand its products to the emerging markets such as china, India and japan.

OTTOBOCK HEALTHCARE

Ottobock Healthcare is a German prosthetics company and is a subsidiary of Ottobock Group. It has four divisions which include orthotics, prosthetics, mobility solutions and medical care. The company has its presence in more than 50 countries with a wide sales and distribution channel. The company generated revenue of $940.69 (€847.7) million in FY2015. In 2015, the company invested $62.14 (€56) million in R&D activities. As of 2015, the company has more than 6,522 employees. The company has wide range of product portfolio in upper extremity devices, lower extremity devices, liners, sockets and modular components. Some of the products include C-legs, Michelangelo hand which is a robotic prosthetics.

Key highlights:

- In March 2017, Ottobock Healthcare partnered with Integrum to distribute Integrum's prosthetic components in the US.
- In March 2017, the company acquired BionX Medical Technologies which is offering world's only active prosthetic foot "the emPOWER Ankle"
- In February 2017, the company acquired BeBionic prosthetic products and related business from Steeper, a British med-tech company.
- In February 2017, the company received German design award 2017 under Excellent Product Design Medical category for its Dyneva back brace product.
- In February 2017, the company announced the launch of Prosedo and Pheon mechanical prosthetic knees.
- In January 2017, the company's ProCarve was approved by the International Paralympic Committee for its usage in competition.
- In January 2017, the company entered into distribution agreement with TaiLor Made Prosthetics for exclusive distribution of the Tailor Made prosthetic foot.

Strength:

- In 2015, the company has invested $62.14 million in R&D activities to develop new and advanced products.
- The company has presence in more than 50 countries and now focussing on emerging markets.
- The company has strong product portfolio ranging from upper and lower extremity orthopedic prosthetics.
- The company recorded strong sales in orthopedic prosthetics segment and has wide distribution network across all major regions such as America, Europe, and Asia.

Strategy:

- The company focuses on developing advanced products with new technology. For instance, the company is coming up with new be Bionic robotic hand.
- The company is growing at a fast rate and expanding its manufacturing facilities in emerging countries such as India, China and Japan due to cheap labour and abundant resources.

Opportunity:

- The company focuses on expansion of its products by developing new technologies that improve the performance and usability of existing products to meet the growing needs of its customers. This creates opportunities overhead and increases the operating efficiencies to expand its products to the emerging markets.
- Recently, the company had partnership with an IT company Sycor to expand its product portfolio with new technology.

The Ohio Willow Wood Company

The Ohio Willow Wood Company is an American company which manufactures, design and distributes prosthetics products and solutions for amputation surgeries. The company offers trans-femoral, trans-tibial, upper extremity liners and low, moderate, high activity prostate foot including the Alpha family of liners, the Fusion foot and the OMEGA CAD system. The company also provides paediatric products which include paediatric foot, paediatric liners and modular components such as cosmetic foam products and custom fabrication products such as check sockets and laminate sockets. The company serves their patients and clinicians through a wide network of sales and distribution in Asia, North and South America, Europe, Africa and Middle East.

Key highlights:

- In January 2016, the company received Ohio Department of Health Award for delivering a healthy work environment.
- In June 2015, the company did innovative partnership with OPIE network to increase their product portfolio.
- In April 2015, the company collaborated with The Ohio state university to improve trans-femoral sockets.

Strength:

- The company has strong product portfolio and offers lower extremity prosthetics, CAD/CAM technology for prosthetics and orthotics, and Custom fabrication of prosthetics.
- The company has its presence in almost every region which includes the Americas, EMEA, and APAC.
- The company manufactures products for both geriatric and paediatric patient to serve them better.

Strategy:

- The company focus on developing high quality orthopedic prosthetics, thereby serving a broad range of patient groups and to become world leader in the market. Also, the company offers customized products such as Prosthetic Liners, prosthetic feet, and modular components for pediatric patients.
- The company has its presence across the globe and is now focusing on untapped markets which generate the revenue of the company.

Opportunity:

- The company focusses on enhancing investor relations to have a strong business relations in future and deepening relationship with customer to provide better services to them.
- The company focuses on new product development with advanced technologies and also provide custom solutions using traditional methods and OMEGA technology to deliver prosthetics. This will provide company with significant growth opportunities and increase their sales in the long-term

STUDY OBJECTIVE

- To analyse the current & future market outlook of orthopedic prosthetic through various segment and region.
- To know the technological advancement in orthopedic prosthetics market.

LITERATURE REVIEW

M Seth et al.Prosthesis is an artificial device which is used when the person loses its body part due to trauma cases, chronic diseases or due to other congenital diseases which lead to the replacement of body part. Earlier, conventional orthopedic prosthetic devices were available which do not provide proper balance and support to the body and sometime causes infection to the body parts. Nowadays, due advancement in technology, new orthopedic devices have been introduced which helps to replace the affected body part with artificial prosthetic which provide a better life to an individual. There are various advanced prosthetic devices were available which is used in several amputations such as trans-tibial amputees which occur due to vascular diseases and causes balance abilities. It can also be occurs due to trauma cases in the patients with vascular diseases as minor injury can from a fall may develop ulcer and affect the health of a person. People with trans-tibial amputation are unable to balance their posture as compared to healthy individuals. Transfemoral amputee is the major factor for the use of hip prosthesis which occurs in lower extremities. Hip prosthesis in the sitting posture is useful for bilateral transfemoral amputees with unhealed residual limbs after burn injuries to prevent disuse and maintain motivation for walking. As per the study conducted by NIH, most of the lower limb amputations occur in people with peripheral arterial occlusive disease and 50% of the people have diabetes. Amputation leads to poor quality of life in people with peripheral arterial occlusive disease. Prosthesis is used as a primary alternative to improve the quality of life. People can able to walk easily through lower limb prosthesis and provide better quality of life in people with lower limb prosthesis.

Diabetes is the major cause of amputation which occurs due to high blood sugar level and can cause several problems such as heart diseases and peripheral arterial diseases which can lead to the need of amputation below the knee. Type-2 diabetes is the major cause of amputation which occurs when the plague or fatty acid deposits on the wall of arteries resulting into narrowing of vessel which can be serious and causes amputation of the lower extremities. In the UK in 2012, 3.9 million people had diabetes and 540 patients were treated with amputation surgeries of lower extremity per month which is due to obesity and type-2 diabetes

The demand of orthopedic prosthetics is also fuelled by injuries, accidents, birth defects and few individuals would like to get advanced orthopedic prosthetics. Rising aging and geriatric

population is directly correlated to the onset of diabetes and vascular diseases. These are the leading causes of amputation. In the US, there is an increased rate of limb amputation incidents estimated to be 2.1 million amputees and about 195,000 amputations surgeries are performed every year. Of those amputations performed, about 82% are due to diabetes and peripheral vascular diseases. According to NIH report, prosthetics use varies from 27% to 56% for upper-limb amputation and 49% to 95% for lower-limb amputation. In western developed countries, there is high rate of lower limb amputation and the adoption of orthopedic prosthetics is high. Limb loss is not affected only to aged. Every day in the US, children are born with missing limbs, and teenagers suffer amputation due to cancer or accidents.

In high population countries, such as India and China, diabetes and road accidents are the major cause of amputation and due to which artificial limb replacements take place. In 2014, around 103 million people had diabetes in China. In India, around 69 million people were living with diabetes in 2015 and 6,840,144 people were injured in road accidents in 2016. In Sub-Saharan region as well, road accidents, diabetes and other congenital disorders are the major factor for amputation and artificial replacements. Advanced technology such as be Bionic hand, robotic legs, Michelangelo hand, microprocessor knee and upcoming technology will contribute to the growth of the orthopedic prosthetics market in this region.

RESEARCH METHODOLOGY

- **Study Design:** Descriptive and Exploratory study

- **Study Area:** Bangalore

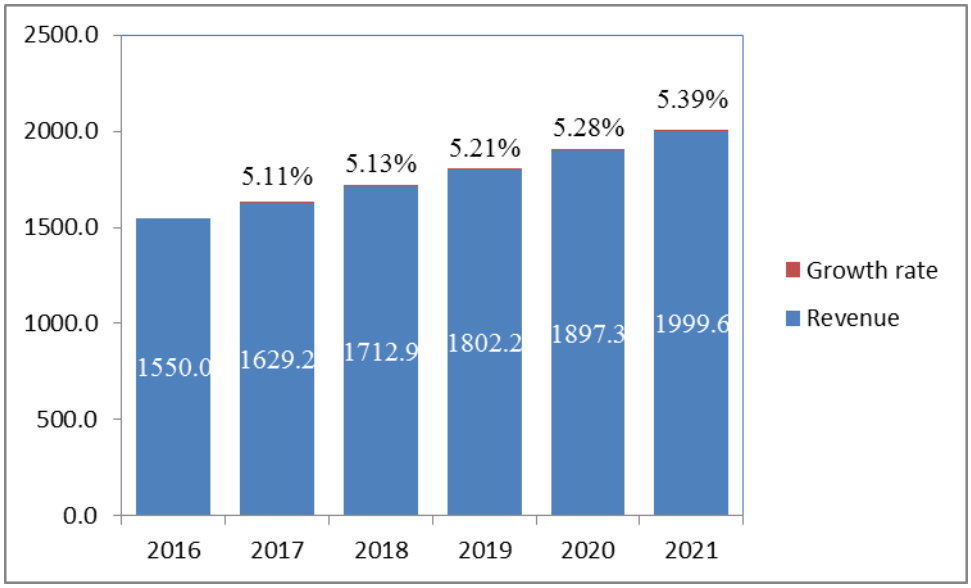
- **Duration of study:** 30th January 2017 – 1st May 2017

- **Data collection procedure:**
  - **Primary research:** Data is collected through primary research with structure questionnaire. The research questions has been asked from industry experts, manufacturers and strategic decision makers.
  - **Secondary research:** Majorly, the data is collected through secondary research after reading articles, journals, literatures and internet.

- **Data analysis tools:** MS excel and SPSS
- **Sample Size:** 20

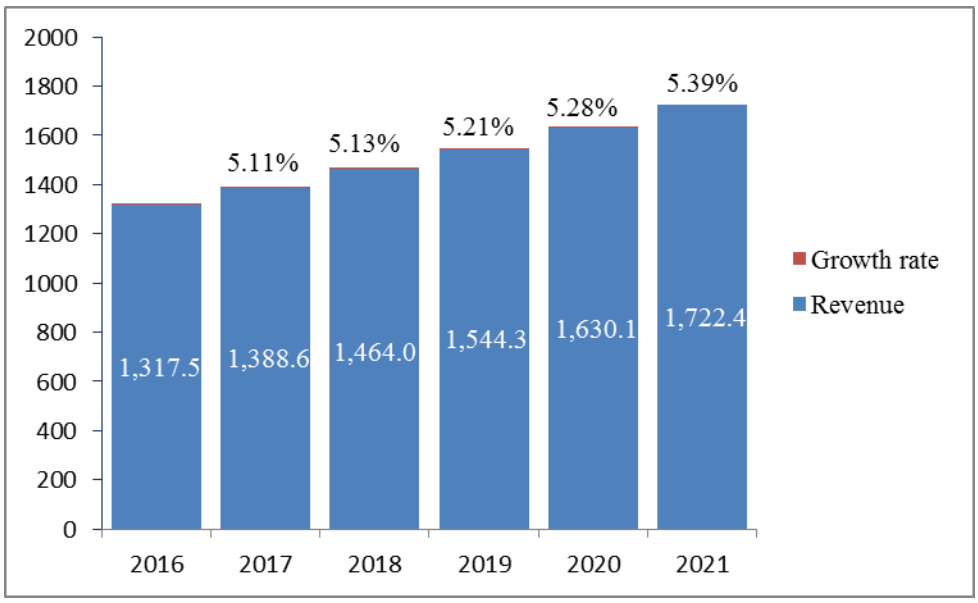
DATA INTERPRETATION

- **Global orthopedic prosthetic market in terms of revenue ($ millions)**



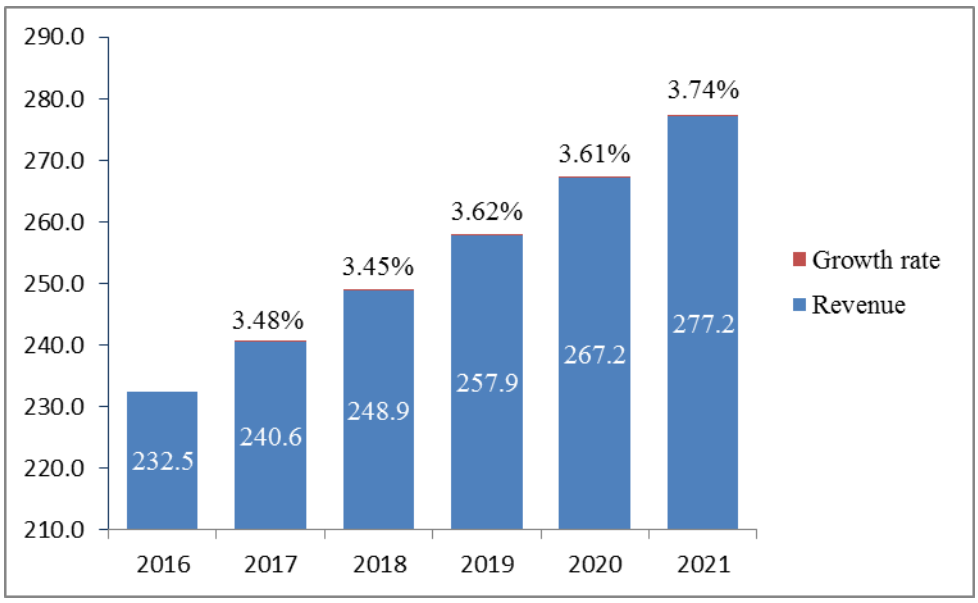
The global orthopedic market will have a significant growth during the forecast period. The market will grow due to trauma cases, high prevalence of diabetes and congenital diseases. The complexities in the movement associated with the knee require more energy to walk then a normal person walks with two legs. The Advanced technology prosthetic devices such as microprocessor knees, Michelangelo hand, hydraulic ankle technology, mind-controlled humonics solution and their high adoption rates has addressed the need of many people around the globe, this will drive the market in future. These advancements have catalyzed the modernization of orthopedic prosthetics owing to increase in sales and demand in the market. The market has wide range of newer and more advanced designs, carbon fibre, mechanical linkages, motors, and after employing hydrualics, and innovative combination of these technologies will provide more control to the user.

- **Global lower extremity prosthetic market in terms of revenue ($ millions)**



The lower extremity orthopedic prosthetics market is growing at a faster pace and is expected to dominate during the forecast period. The increase incidence of amputees is due to diabetes peripheral diseases, injuries and trauma causing higher number of limb amputation. The increase in aging population, people aged above 65 is growing nearly at triple rate when compared to that of people ager under 50. This has a direct correlation between age and the onset of vascular and diabetes, which are the leading causes of amputation. The technological advancement in lower limb prosthesis has drastically changed the prosthesis in recent decades. The overall amputation rate for lower limb in developed countries has remained high due to increased satisfaction, comfort, and customization. The advances include: components material, new suspensions, socket configuration, and advances in knee mechanisms. These advances have led to development of lighter, stronger and more aesthetic acceptable materials have enabled amputees to replace their older prosthetics with the newer prosthetics. This will result the treatment in effective with shorter duration time giving the amputee enhanced mobility and offer active lifestyle. The advances have also increased the visibility and prevalence of prosthetics in sports such as running, tennis, and skiing.

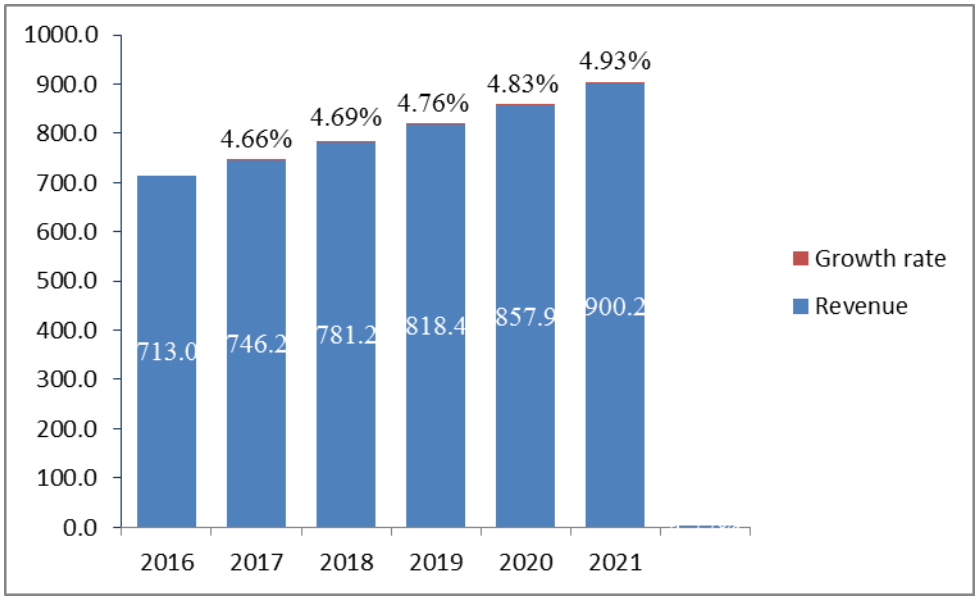
- **Global upper extremity prosthetic market in terms of revenue ($ millions)**



The upper extremity prosthesis is referred to artificial arm that requires to perform more functions in daily activities such as transport of objects held in hand. The energy required for operation of upper prosthesis is derived from the relative motion between the two parts of the body. There are different types of terminal devices such as hooks, sockets, and grippers that are used for upper limb prosthesis that have different types of functions. These are the devices which is used when an individual has underdone amputation of upper extremity such as shoulder, arm, forearm, wrist and hand which occurs due to sports injury or trauma cases. These upper body parts are then replaced by artificial prosthetics for the movement of upper extremities.

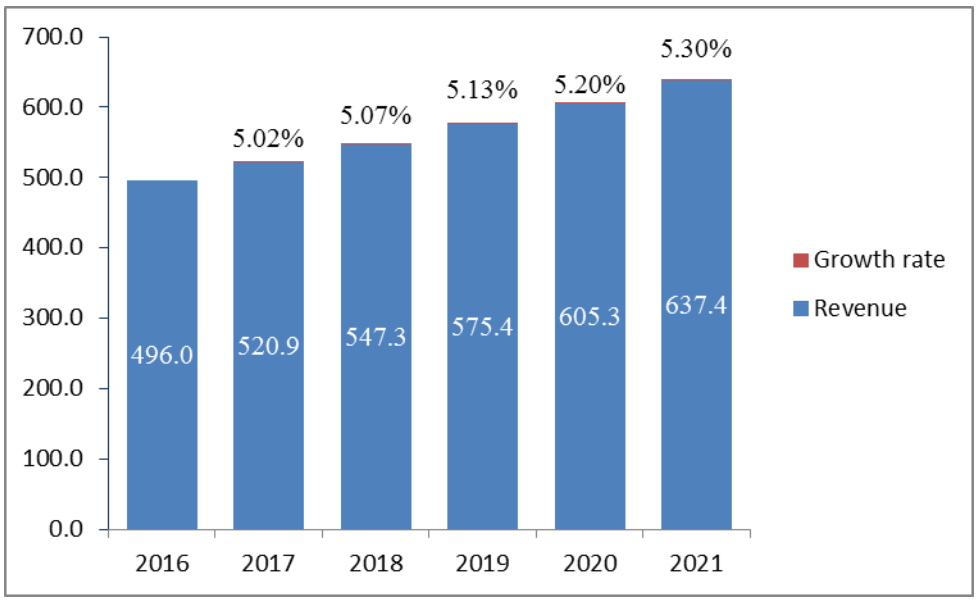
The upper limb prosthetics contributes to overcome daily routine problems caused due to limitation in the interfaces providing prosthetics to increase user satisfaction rates to reduce device abandonment. The upper limb prosthesis is classified into two cosmetic and functional that include both body-powered and externally powered. Most of the companies are focussing in offering body-powered upper limb prosthesis and upper extremity prosthetics products have less number of cases as compared to lower extremity prosthetics due to less prevalence of diseases and trauma cases.

- **Orthopedic prosthetic market in Americas in terms of revenue ($ millions)**



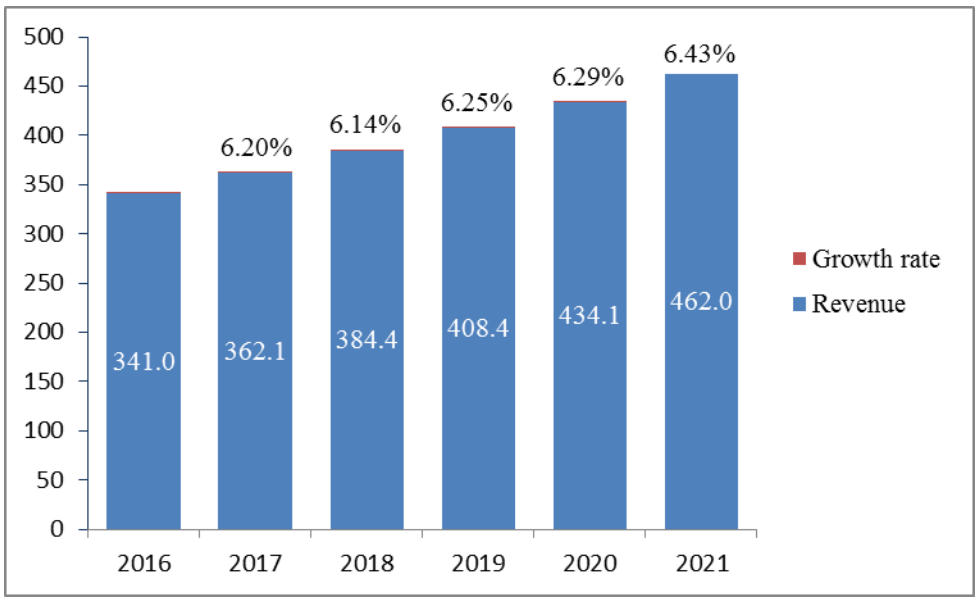
In 2016, orthopedic prosthetics market in the Americas accounted for a dominant share of and is expected to retain its dominant position over the coming years. The increase prevalence of diabetes and peripheral vascular diseases related to limbs and sports related injuries have contributed to the growth of the market.

- **Orthopedic prosthetic market in EMEA in terms of revenue ($ millions)**



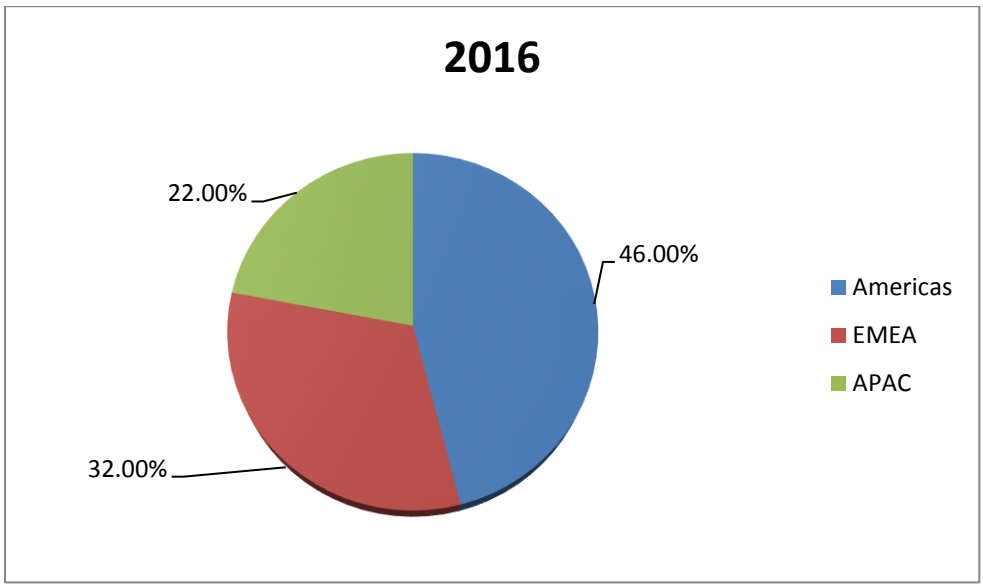
Orthopedic prosthetics market in Europe had a significant market share in 2016 which is due to trauma cases and high prevalence of diseases in the region. Advance technology, rise in awareness among people regarding artificial prosthetic devices are the major growth factor. The major revenue contributors to this region were from most of the Western European countries such as the UK, Germany and France which is due to advanced healthcare structure and presence of key players in the market.

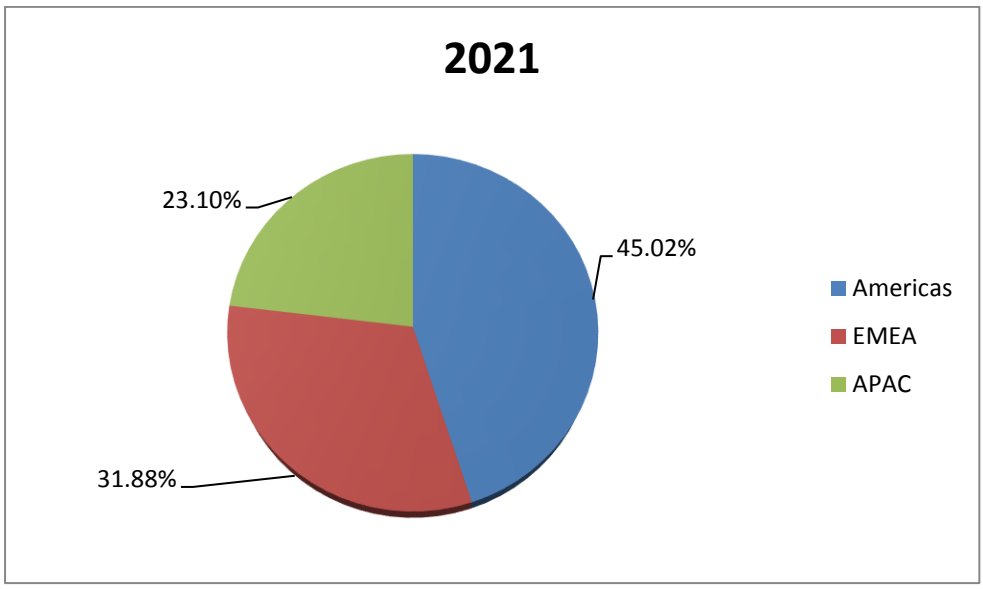
- **Orthopedic prosthetic market in APAC in terms of revenue ($ millions)**



Orthopedic prosthetics market in APAC region is growing at a fast rate which is due to the large population in the countries such as India and China, due to which the high prevalence of diabetes and road accidents are the major factors for large amputation surgeries. In countries, such as India, China and Japan, Technological advancements such as robotic leg, be-Bionic Hand Hydraulic ankle technology and microprocessor knees and rise in the awareness among people regarding prosthetic devices are the major reasons for growth.

- **Orthopedic prosthetic segmentation by geography (%) 2016 and 2021**





The market is dominated by Americas which is due high prevalence of diabetes and presence of major player in the region. Europe accounts for second largest share which is due to advanced healthcare and rise in the number of ASCs and rehabilitation centres. APAC is the fastest growing region which is due to large number of geriatric population with diabetes and rise in the awareness of prosthetic devices among people.

- **Respondents were asked to tell about orthopedic prosthetic products of the company?**

Company name	Product name
Ossur	Rheo Knee
Blatchford	Microprocessor knee
Ottobock Healthcare	Michaelangelo hand
Fillauer	Body powered hand
Ossur	Genium X3
The Ohio Williow Wood Company	Trans-femoral sockets

- **Respondents were asked to tell the major parameters considered by end-user before buying orthopedic prosthetic devices?**

- Price
- Quality
- Advanced technology
- Durability
- Attributes

- **How the market is performing in the next five years?**

- Most of the respondents replied that the market is growing due to availability of advanced prosthetic devices.
- Increase in the geriatric population will lead to the use of orthopedic prosthetic devices.
- High adoption rate of advanced prosthetic over conventional prosthetic devices will lead to the growth of the market in coming years.

- **Respondents were asked to tell the major trends that will have an impact in the market during the forecast period?**

- Growing focus towards customised orthopedic prosthetics devices.
- Emergence of mind-controlled humonics solutions.
- Technological innovations and product launches.
- Growing demand for myoelectric prosthetics.

- **Respondents were asked to tell in terms of geographic split, which market is growing and why?**

- 70% of the respondents replied that America has dominated the market due to availability of advanced orthopedic prosthetic devices and presence of major and small vendors in the region.
- 30% of the respondent replied that Europe also has the significant market share due to presence of advanced healthcare system and high adoption rate of advanced prosthetic devices.

- **Respondents were asked to tell which region is expected to witness fastest growth in next five years?**

- Respondents replied that, although the market is dominated by America and Europe but APAC is the fastest growing segment due to the large number of geriatric population and most of the large and small vendors are setting-up their manufacturing facilities in this region due to the cheap labour and abundant resources.

- **Respondents were asked to elaborate the major drivers and challenges in the market?**

  Major drivers which contribute to the growth of the market are:

- Growing number of birth defects and trauma cases.
- Availability of technically advanced orthopedic prosthetic devices.
- Growing number of amputation surgeries and focus on restoring mobility among amputees.
- Rising sports related injuries.

  Major challenges which hamper the growth of the market are:

- High cost of prosthetic devices
- Risk and complications related to prosthetic devices.
- Insufficient reimbursement policies couples with reimbursement denial by private insurance companies.

- **Respondents were asked whether the market is highly fragmented or dominated by top players ?**

- According to respondents, the market is highly fragmented due the presence of large and small vendors. Small vendors compete with large players on the basis of price, quality and availability of products.

- **Respondents were asked to tell the names of some potential start-ups players in the market who can give high end competition to the key players in the near future?**

  According to respondents, some potential start-up players who can give competition to major players are:

- Fillauer
- TAL Innovations
- Steeper
- ATP Amputee
- Meditex
- Aesthetics Prosthetics
- Touch bionics
- Proteor
- Orthomerica

CONCLUSION

Prosthesis is an artificial device which is used to replace missing body part which may be lost due to disease, trauma cases such as road accidents and other congenital disorders. Limb prosthesis can be of two types such as upper-limb prosthesis which may occur due to elbow disarticulation, wrist disarticulation, transhumeral prosthesis and lower-limb prosthesis which may occur due to knee disarticulation, transfemoral prosthesis, transtibial prosthesis or ue to syme's amputation.

The global orthopedic prosthetic market is growing at a CAGR of 5.23% which is due to high prevalence of diabetes and rise in the number of trauma cases such as road accidents. Lower extremity prosthetics has dominated the prosthetics market as compared to upper extremity prosthetics which is due to high prevalence of diabetes which causes foot ulcers and requires sudden amputation surgeries. Road accidents are also the major factors which mostly affect the lower body part as compared to upper body part. The availability of large number of advanced prosthetic devices for lower extremity was the major growth driver. Americas has dominated the orthopedic prosthetic market which is due to incidence of road accidents and use of advanced technology prosthetic devices to replace body part. In 2016, North America has the largest market share which is due to the presence of major players who offers advance prosthetic products. Europe has the second largest share in orthopedic prosthetic which is due to advanced healthcare system and rise in the awareness of orthopedic prosthetic products. Diabetes and road accidents were the major factors of growth. The increase in the number of rehabilitation centres and ambulatory surgical centres (ASC's) leads to the growth of the market. The developed countries such as Germany, France and UK have advanced healthcare systems which provide safe and better surgical treatment to the patient who have undergone different amputations. Presence of major players and availability of advanced prosthetic products will contribute to the growth of the market. APAC is the fastest growing market which is due to the large pool of geriatric population in the region. India and China has the large number of diabetic population which leads to amputation of lower extremity. Rise in the number of road accidents and awareness among the people regarding use of orthopedic device will contribute to the growth of the market in coming years. Japan and Australia has dominated the market in APAC region which is due to the advance healthcare and availability of advanced prosthetic devices. Most of the major players

are shifting their manufacturing facilities in this region which is due to availability of cheap labour and abundant resources.

The market is highly competitive with the presence of large and small vendors. Some of the major players includes Ossur, Ottobock Healthcare, Endolite, Ohio Willow wood company and Blatch ford who has dominated the market with their advanced prosthetic products. The presence of other prominent vendors such as TAL Innovative Solutions, Fillauer, MTP Amputtee, Freedom Innovations compete with large vendors on price, quality and availability of products in the market.

TEMPLATE

1. I would like to know about **Orthopedic Prosthetic** product offerings in your company.
2. What are the major parameters considered by the end users before buying?
3. How do you see this market performing in the next five years?
4. What will be some of the trends that will have an impact in the market in the coming years?
5. In terms of geographic split, which markets are growing and why?
6. Which of these regions is expected to witness fastest growth in the next five years? What could be its growth rate?
7. Could you please elaborate on the major drivers and restraints in the market? Do these drivers and challenges differ in each region? If yes which region is affected the most?
8. Is the market highly fragmented or dominated by top players?
9. Can you name some potential start-up players in this market who can give high end competition to the key players in the near future?

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