**Researches**

# How successful were the Allies in mobilizing technology for war, 1939-45?

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## ABSTRACT

*The Second World War was the most important and life changing event in the 20th century. The world was fought in the pacific, the Middle East, Europe, Asia, Africa, Australia and North America. There were battles between Allied powers which included Britain, France, Russia and USA. Also, Axis powers that consist of Germany, Italy and Japan. Therefore, mobilising technology had importantly changed during the Second World War. This war became necessary to merge the government policy and technology to achieve full mobilisation and improve the modern world weapons. On the other hand, there was a development of radio communications, industry, medicine, electronic and military power that had a big influence on the 20th century technology. Additionally, there were numbers of new military technology progress in the Second World War by the Allies for instance, progressing the first Atomic bomb. Furthermore, this essay will discuss the technological progress during this war as well as the invention of many discoveries that were approach the Second World War positively and negatively.*

## Introduction

The Second World War was the most significant and life changing event in the 20th century. The war was fought in the Pacific, the Middle East, whole Europe, Asia, Africa, Australia and North America. There were battles between Allied powers which included Britain, France, Russia and the US and Axis powers that consist of Germany, Italy and Japan. (Oxford University Press, n.d.).Therefore, mobilising technology was importantly changed during the Second World War. In this regard, Guy Hartcup states that in the Second World War, there were six important developments or strategies that grew from the war by Axis and Allied science; for example, ''atomic energy, radar, rocket, propulsion, jet propulsion, automation and operational research'' (Hughes and Philpott, 2006, p244).

The Second World War became necessary to merge the government policy and technology to achieve full mobilization and develop new and modern war weapons. The 'Command Technologies' created, were incredible to warring states. Government orders in industries were able to satisfy the strategic and tactical needs of armed forces. Thus, rising complexity of weapons production was the main invention of the Second World War (McNeill, 1983: p356). Therefore, during the Second World War technologists, design engineers, scientists and experts were ordered to develop new inventions and mass production than ever before (McNeill, 1983: p357). Unlike the usual business of fulfilling

market demand, the industries were not always able to fulfil the demand so the state approached private companies to fulfil their ambitious defence research, which involved huge sums of money (Hughes and Philpott, 2006: P243).

On the other hand, there was development of radio communication, medicine, industry, and electronics and military that had a big influence on the technology 20th century. In addition, there are a number of new military technology developments in the Second World War by the Allies; for example, progressing the first atomic bomb, Manhattan project was began by the USA in 1942. Therefore other inventions such as radar and sonar were successful by the Allies for discovering the location and submarines. Despite this, invention Buna S and Buna N was important for example, Buna S was a type of synthetic rubber and Buna N was for oil-resistance uses (Wolf, 1948).

Furthermore, this essay will argue technological development during the Second World War. In addition, many discoveries, inventions and production approaches were created during the World War II by the Allies for shaping human society such as, jet engines, breaking the Enigma code, computer and penicillin. In this regard this essay will argue that the technology was successful by looking at emergence of atomic bomb, radio communication, invention of penicillin, radar and sonar, Enigma code breaker and proximity fuse which were incredible inventions by the Allies during the Second World War (1939-1945).

## How successful were the Allies in mobilizing technology for war, 1939-45?

According to Hughes and Philpott (2006: p246), the Allies' development of atom bombs called the Manhattan Project brought together engineers and scientist into one huge effort and this was the first time when in pursuit of weapons the groups of engineers and scientists had come together. It utilized the work of European, often Jewish émigré and scientists like Max Born, Albert Einstein, John von Neumann, James Frank, Leo Szilard, Edward Teller, Niels Bohr and Enrico Fermi. In 1942 after presidents order to build the bomb the work started in full flow and scientist became the captives of the enterprise. Therefore, the emergence of atomic bomb addressed the new

technology in the world. In 1942 the program of developing atomic bomb was placed under the command of the American army which was known the Manhattan project. Therefore, about 129,000 people were working on the Manhattan plan which were including workers, scientists, construction (structure) and military personnel employees by 1944 (Oxford University Press, n.d.). Despite this, according to McNeil (1983, p359) 120000 labours worked at Manhattan project which included many world's prominent physicists (McNeill, 1983: P359). The UK accepted that the industrial and research effort required to create a bomb quickly in June 1942. ''America took over the whole project''.

In addition, the scientists in Britain were co-opted to three ''secret cities''. Firstly, Oak Ridge, Tennessee to build the uranium separation plants. Secondly, Hanford, to produce plutonium. The last one was New Mexico desert at Los Alamos, research laboratory or where the laboratories were established. . Thus, the bomb project named Manhattan or DSM (Development Substitute Materials) was thrown in August 1942. For examining the atomic programme, two American physicists were sent to the UK. As a result of that they described that the bomb was a realistic programme (Overy, 1995: P241). As it is clear, the atomic bomb was an obvious example of addressing new technology and science in the Second World War. Therefore, it was a massive and successful project by the Allies. In addition, creating the Manhattan project by the America showed the growing importance of technology in military system and to exploit for the military purposes.

However, during the Second World War, there were some techniques for encouraging people to think and work in a specific way by radio, posters, newspapers and other methods of mass communication for example, showing the short newsreels before feature films in cinemas (Oxford University Press, n.d.). The documentary movement which was a help to these goals was invented in this era and its aim was partly to encourage people participation in the scientific and technological revolution and development which obviously were in the benefit of governmental purposes. Although, there was a great development in training approaches during the Second World War, for example using energetic films, technical guides and simulators to recreate battle situations in a laboratory location to help in training.

Therefore, the electronic elements and new materials such as plastics which led to made Handie-Talkies and other radios that was acceptable for soldiers to communicate across ocean and across a pacific atoll (National WWII Museum, n.d.).In addition, radio played an essential role in order to connect tank to tank and tank to aircraft. Good communications improved the flexibility of armoured forces and aided to focus of its firepower. They were important in ''some in trucks, some in armoured carriers, engineers, artillery and anti-aircraft batteries'' (Overy, 1995: P210).Also, American support created perhaps the revolution in radio communications by providing 35,000 radio station, 956,000 miles of telephone cable and 38,000 ground telephones. Furthermore, the soviet air power focused on developing ''radio control of its aircraft and radio communication'' between air and ground powers during 1943 (Overy, 1995: P214).

It can be argued that during the Second World War the process of communication was important especially for those countries participated in the war. The strategic use of communication served as a means of intensifying people's participation in the war related issues. Therefore, innovation radio played a significant role for mobility and also radio communication became the special development in the Second World War which was supported by the Allies.

At all times, science has been significant in warfare (Hughes and Philpott, 2006, p, 243). The Second World War changed the science and technology enterprise of the US considerably. The office of scientific research and development was created by the president on 28 June of 1941. President Franklin D. Roosevelt provided an executive order to make the National Defense Research Council (NDRC) on June 12 1940. Therefore, Vannevar Bush presided the NDRC, previously he was as a Dean of engineering at the Massachusetts organization of technology and after that as a leader of the Carnegie organization of Washington. Other members were consisted of ''James B. Conant, President of Harvard, Karl Compton, President of MIT, and Frank Jewett, President of the Bell Laboratories and of the NAS''. Between 1939 and 1940 of the academic year, 150 research was performed by the academic sector at the universities of the United States within engineering and natural sciences (Atkinson and Blanpied, 2008). During

the Second World War, Charles Percy who worked with a number of the optimistic scientific minds in the UK, he realized that technological and scientific inventions were essential parts of the war effort (Jensen and Wiest, 2001: P241). Despite this, possibly, one aim that the Allies were successful in was because of having three strong administrators such as British, American and Canadian. Therefore, these countries worked together on their scientific programs (Higham, 1999). For example, in terms of science during the Second World War, health and medicine improved in the Britain. In addition, invention of some new drugs such as penicillin and sulphanilamide, and insecticides such as DDT that suddenly changed all environments and also decreased the risks of diseases caused by infection (McNeill, 1983: P360). The first observation of the anti-bacterial impact was invented by Alexander Fleming in 1928. But it was less done until 1939 when Ernst Chain observed to Fleming's effort for extra information on lysozyme. Therefore, Howard Flores's research at Oxford laboratory was to show the effectiveness of penicillin. It was not more produced until the summer of 1941, when Florey and his partner Norman Heatley travelled to the USA and carried penicillin to focus on a number of American makers (Liebenau, 1987).

Consequently, the invention of penicillin helped soldiers to protect them from bacterial infections during the Second World War (National WWII Museum, n.d.).According to Hughes and Philpott (2006: p250) in the years 1930s and 1940s there were great advances in the blood transfusions that proved beneficial for the wounded men to keep them alive and helped their chances of recovery. The biggest discovery happened in 1920s of the antibiotic drug; penicillin, which was mass-produced by USA from 1943 onwards. It worked wonders against infections and got widely available to allied troops by 1944. Therefore, In 1943 United States turned out over 21 billion units of penicillin, in 1944, 1,633 billion units and in 1945, 7,052 billion units. It was majorly used for the vast forces of allied soldiers with sexually transmitted diseases (STD's). This penicillin did the job of curing syphilis in just 8 days unlike the old treatment with arsenical drugs and bismuth took 40 – 50 days. Also penicillin cleared gonorrhoea in 2 – 3 days. Although, Harrison pointed out the forwardness of British thinking in military

medicine after 1939, he finds out that British learnt its lesson in North Africa, Italy, Burma and reached its apogee in Normandy in 1944. Also, according to Harrison in the age of total war the use of good medical services is very essential for achieving maximum benefit from British forces. Despite this, there housed little tension in the medical services due to the behaviour of US General George Patton in the Second World War (Hughes and Philpott, 2006: P251). It might be argued that the Second World War was a huge development in medical science. In this regard, invention of penicillin was great important to the Allies powers such as US and Britain. Therefore, this drug was effective by the Allies to protect soldiers from bacterial infection and transmitted disease.

After the First World War, Arthur Scherbius invented the Enigma machine. After that it was used by Germany before and during the Second World War. It was for sending secret messages to encrypt and decrypt by the Navy, railway stations, civil service, Army units, the Luftwaffe and everybody else (*Singh, 2003)*. Blitzkrieg tactic was a new technique of sending secret messages during the World War II by the German. Hence, Allied powers were unable to break the Enigma code. Then a machine which could discover the code was developed by a team of British code breakers. Therefore, it allowed the Allied power to interrupt German communications in the battlefield (Oxford University Press, n.d.). The Ultra process was helped by the Poles who provided a captured enigma Machine to the British in 1939. By January 1940, the Abwehr's hand codes and by December 1941, the Enigma cipher were broken by the British intelligence. Ultimately, the British broke all of the different Enigma system. American and British intelligence groups were reading 2000 to 4000 decoded German letters every day by the end of the war. (Bacon, 1998).

In addition, during the Second World War, the contribution of the signal intelligence was significant, especially in terms of the Allied breaking of the German Enigma codes which was still being evaluated by the researcher (Jensen and Wiest, 2001: P77). Thus, the Enigma cipher was cracked by the Allied code breakers at Bletchley Park regularly (*Singh, 2003).* On the other hand, by the end of the war, scientists and engineers started the structure of electronic digital computers and code breaking applications. (National WWII Museum, n.d.). The electronic computers used the director

systems were of the great use in wartime and after war's electronic computers (Hughes and Philpott, 2006: p245). It can be argued that special technology such as Enigma machine was used to break the code and also it was used to crack successfully by the Allies. Therefore, sending secret messages was typed by the Enigma operator. Thus the Enigma cipher was broken and it was a successful technique. Therefore, the Allies use computers to break the code and to read messages.

As can be seen in this paragraph Radar and Sonar were used during the Second World War that contributed to the Allies success. Therefore, these techniques were for discovering the location and rapidity of enemy aircraft or submarines. Radar played an important role in the British success in the aerial battle during the Second World War which was in August 1940. The success of the UK in the battle was because of having a sets of radar stations which has been built alongside the Eastern and Southern coasts of the United Kingdom in 1939. On the other hand, the use of sonar was conducted against German submarines. Also, using sonar was acceptable to Britain to distinguish the location and submarines. These two technologies radar and sonar waves show the possessions of all waves which consisted of ''wavelength, frequency, velocity, reflection and changes in wavelength''. Using of sound waves to show distant objects is made by sonar and also radio waves which are more near to light than sound is used by radar. (Garcia, n.d.). However, during the Second World War, Radar or radio detection and ranging was used to trail aggressive bombers. For instance, to straight gunfire, to direct bombers to their objectives, for airplane-to-airplane battle and also to track mortar bullet back to their targets. This important technology was used later in other things such as in the improvement of satellite computers, television and digital computers. Radar was known as a new type of electronics which managed high rapidity of electronic pluses (National WWII Museum, n.d.).

For the first time radar navigation and ''Sperry'' bombsights and the coveted ''Norden'' were used during the Second World War. Potentially, these technological inventions reduced the chances for collateral harm and larger judgement between military and civilian objects (Kaszuba, 1997). The British tried to learn a technological secret from the US, it was Norden bomb sight. (Jensen and Wiest, 2001:

P255). Thus, during the Second World War, radar was an important invention. Using reflections of short radio waves was discovered by British engineers and scientists for locating airplanes at enough distances for the interception by combatant pilots during the fighting. Furthermore, during the war, radar developed continually and quickly (McNeill, 1983: p359).

During the Second World War, the relationship between the Government and scientist in the UK was jumble of success and failure in terms of improvement of radar and the jet engine. Therefore, using of radar was successful because of the efforts of a group of scientists determined to apply its technology properly (Jensen and Wiest, 2001: P 258). Also, the United States had much information about passing jet engine to the General Electric (GE) Company by July 1941. In February 1943, the I-14 ran was the first GE manufacturing engine. In July 1943, it was substituted to the I-16. (Jensen and Wiest, 2001: P 256). Therefore, the United Kingdom was successful in the improvement of its radar but with jet propulsion it was less successful (Hughes and Philpott, 2006: p245). The jet engine was a machine with the shine of mechanical progress and an accurate development. In February 1940, the British Air Ministry decided to make a jet engine. Between 1940 and 1941, they paid to construct the first jet engine production factory at Barnoldswick, Lancashire. During the war, they also paid to dedicate jet propulsion. Furthermore, at Barnoldswick the Britain's jet engine factory was conducted by the Rover Car Company. At the end 1943, the series manufacture of jet engines initiated in the United Kingdom. The first jet fighter in Britain was the Gloster Meteor which powered by Rolls-Royce Welland jet engines and in the same time entered service like Me 262 in the end of July 1944. (Giffard, 2013). It is clear that radar and sonar were other advancement inventions of technology during the Second World War while jet engine development seemed less successful. Radar technology was developed by the Allies and both radar and sonar was extremely useful in the war for protecting themselves from attacks. Therefore, these technologies such as radar and bombsights played an important role in the battlefield and these significant creations during the war lead to victory and changing the world.

A joint scientific mission was recognized by the Americans and British in 1940. Moves like that brought about drastic change and growth into gigantic coordinated effort where all leading British, Canadian and American universities, and research departments of all leading armed services were involved. All the Allied nations worked hard and immensely to improve their old weapons and come up with new improved weapons and also to invent countermeasures to reduce the deadliness of enemy weapons (Hughes and philpott, 2006: p244). The consequences were far-ranging and notable war weapon and strategic scientific advancements. These included the invention and progression of new technological aspects such as of Radar, proximity fuses, electronic fire control equipment, anti-submarine weapons such as ''Hedgehog and Squid, incendiaries, rockets, frangible bullets, flail tanks, bailey bridges, Mulberry and harbours, DUKW floating vehicles, landing craft, the colossal computer and asdic'' (Hughes and philpott, 2006: p244-245). Allied forces where very impressed with some of their inventions but were afraid to use them because of the fear of it falling into the hands of the enemies and being cloned by them to use the same weapons against the Allied forces. (Hughes and philpott, 2006: p245). Although, the Allies made a remarkable invention of proximity fuse in 1944, which was even termed as variable time fuse. This was remarkable because in it the scientist built small radar set – power, transmitter, and receiver - inside explosive shell, which allowed it to explode right next to the target rather than on contact (Hughes and Philpott, 2006: P245). Thus, it seems that during the Second World War, science progress had the most important role in order to invent new technologies. Therefore they worked hard in the laboratories and famous universities for inventing and to do new innovations. Thus, most of those inventions were developed by the Allies power for example; in 1944 they created an incredible invention of proximity fuse. In addition, they were very successful in mobilising technology in wartime.

On the other hand, Edward Tschunkur and Walter Bock were the inventors of the styrene copolymer which was known Buna S. Therefore, Buna S was one kind of synthetic rubber and also ''Buna N was for oil- resistance uses which was invented by Tschunkur and E'rich Conrad. Furthermore, the American rubber men were familiar with the Buna N and

Buna S. Therefore, Dinsmore, Sebrell and Semon were the American rubber chemists who were visited the I.G. plants in Germany to see what was prepared in the emulsion polymerization of butadiene copolymers. Thus, in 1940 two of the biggest American rubber companies got permission from standard oil to make Buna S and Buna N (Wolf, 1948). In addition, the government of Soviet supported the development of synthetic rubber in terms of science and technology (Lewis, 1979). Despite this, the Allies powers were not free in of oil difficulties for all their greater supply of oil resources. Therefore, the UK did the combat for keeping the oil supply from the US across the Atlantic between 1942 and 1943 (Overy, 1995: P 233). Furthermore, an organised attack on synthetic oil production began by the Allied bombers powers in May 1944 and 127 oil assaults were mounted by the US air power (Overy, 1995: P232). Thus, the Allies powers which are American, Russian and Britain engineers with the invention of these technologies were beneficial even after World War II that continues to nowadays.

## Conclusion

There were incredible advancements in the technology during the Second World War by the Allies for the advantage of war that they even were compelled to involve the money from the private sector as well. In the beginning of the war, the mass communication through film production and radio programmes were encouraged to involve people to the production process and the development of technology. For example the Manhattan project was of great use to the military. Therefore, the emergence of the atomic bombs was a new technology that developed during the Second World War which was known as Manhattan project. It was under the command of American army in 1942 and also it was an important experience because it ended the war directly.

Furthermore, technology and science were important aspects of the World War II; invention of some new drugs such as penicillin was helpful to protect soldiers from infected diseases. On the other hand, there are other technologies during the Second World War which included; proximity fuses and synthetic rubber and oil that were new successful techniques in World War II. What is more, there were other important technologies in the World War II such as the use of the Enigma machine for sending the secret messages to encrypt and decrypt and the Enigma cipher which was used by the Allied code breakers for the purpose of tracking and also for that purpose they use computers to read the letters.

During the Second World War, the operational communication inventions like radio signals played an important role in warfare especially by America and Soviet. In addition, the invention of radar and sonar by the Allies power were new technology progress for discovering the location which was effective for submarine and other goals. Also the jet engine by the United Kingdom was used widely although it was not as popular and successful as the use of radio signal.

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## كيفية نجاح الحلفاء في تعبئة التكنولوجيا خلال الحرب العالمية الثانية ١٩٣٩- ١٩٤٥

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**ملخص:**

حدث تقدم كبير في التكنولوجيا خلال الحرب العالمية الثانية انجزته دول الحلفاء لصالح الحرب التي اضطروا حتى إلى الاستعانة بالأموال من القطاع الخاص. ففي بداية الحرب تم تشجيع وسائل الاتصال الجماهيري من خلال إنتاج الأفلام وبرامج التلفاز لإشراك الناس في عملية الإنتاج وتطوير التكنولوجيا. فعلى سبيل المثال؛ كان "مشروع مانهاتن" ذا فائدة عظيمة للجيش. لذا فإن ظهور القنابل الذرية التي طورت خلال الحرب العالمية الثانية كانت تقنية جديدة والتي كانت تعرف بــ "مشروع مانهاتن" آنذاك. كانت القنبلة الذرية تحت سيطرة الجيش الامريكي في سنة ١٩٤٢ وكانت تجربة مهمة لأنها انهت الحرب فورًا. أضف إلى ذلك؛ كانت التكنلوجيا والعلم جوانب مهمة من الحرب العالمية الثانية، حيث أن اختراع بعض الأدوية الجديدة كالبنسلين كان مفيدًا لوقاية الجنود من الأمراض المعدية. ومن ناحية أخرى؛ كانت هنالك تقنيات أخرى خلال الحرب العالمية الثانية والتي تضمنت فتائل التحكم في توقيت انفجار المفرقعات والمطاط الصناعي والنفط، وهي تقنيات ناجحة وجديدة في الحرب العالمية الثانية. والأكثر من ذلك كانت هنالك تقنيات مهمة أخرى في الحرب العالمية الثانية مثل استخدام "الآلة اللغز" لأرسال الرسائل السرية، وذلك بكتابة الرسائل باستخدام الرموز السرية، وحل الرموز السرية، وكذلك استخدام آلة حل الرموز التي كان يستخدمها مَنْ يحلون الرموز السرية من دول الحلفاء لغرض المتابعة وكذلك استخدموا الحاسوب لقراءة الرسائل. لعبت اختراعات الاتصالات العملياتية التي استخدمتها الولايات المتحدة والاتحاد السوفيتي مثل إشارة اللاسلكي دورًا مهمًا في الحرب خلال الحرب العالمية الثانية. إضافة إلى ذلك؛ فإن اختراع الحلفاء للرادار والسونار كان تقدمًا تقنيًا جديدًا لاكتشاف المواقع والذي كان فعالاً للغواصات ولأغراض أخرى. وكذلك كان اختراع المحرك النفاث الذي استخدمته المملكة المتحدة على نطاق واسع رغم أنه لم يكن شائعًا وناجحًا مثل استخدام الإشارة الراديوية.