

Evolution of Visual Effects (VFX) in Bollywood: A Comparative Study of Pre and Post-2015 Films

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Abstract—The Indian film industry, commonly called Bollywood, has changed a lot in how it uses Visual Effects (VFX) over the past twenty years. VFX means using computers to create or change images in a film. This paper studies this change closely by comparing films made before 2015 and films made after 2015. The year 2015 is used as a dividing point because it was the year when *Baahubali: The Beginning* was released — a film that showed Indian cinema could match Hollywood in terms of visual effects quality.

For this study, we selected six important Bollywood and Indian films — three from before 2015 and three from after 2015. We looked at each film's technology, budget, how VFX was used in the story, and how audiences and critics reacted. We found that films after 2015 clearly show better VFX quality, more international collaboration, higher budgets used efficiently, and a stronger connection between VFX and storytelling. The paper also looks at challenges that still remain, such as the quality gap in mid-budget films, and gives recommendations for how the Indian film industry can continue to grow. This study is useful for film students, researchers, and anyone interested in the future of Indian cinema in the global entertainment world.

Keywords— Visual Effects, Bollywood, VFX, Indian Cinema, Pre-2015, Post-2015, *Baahubali*, *RRR*, *Brahmastra*, Film Technology, CGI, Comparative Study, Digital Effects

I. INTRODUCTION

1.1 What is VFX?

VFX stands for Visual Effects. It is a process used in filmmaking where images are created or changed using computers. VFX can be used to show things that do not exist in real life, like dragons, alien planets, ancient kingdoms, or magical powers. It can also be used for smaller things, like removing unwanted objects from a scene, adding rain or fire, or making a crowd look bigger than it really is.

In modern cinema, VFX has become very important. Audiences today expect films to look visually stunning. Without VFX, many of the most popular films in the world would not be possible. Superhero

movies, fantasy epics, science fiction films — all of these depend heavily on Visual Effects.

1.2 VFX in Hollywood vs. Bollywood

Hollywood started using VFX heavily in the early 1990s. Films like *Terminator 2: Judgment Day* (1991), *Jurassic Park* (1993), and *The Matrix* (1999) showed the world what computers could do in filmmaking. By the 2000s, Hollywood blockbusters routinely spent hundreds of millions of dollars on VFX.

Bollywood, on the other hand, was much slower to adopt VFX. For most of its history, Indian cinema depended on practical sets, physical stunts, and clever camera work to create spectacle. While this produced many great films, the visual scale was limited. When Indian filmmakers first started using VFX in the early 2000s, the results were often seen as below international standards.

1.3 Why 2015 is the Turning Point

In 2015, the Telugu-language film *Baahubali: The Beginning*, directed by S.S. Rajamouli, was released. It was a film made in two parts that told the story of a great ancient warrior-king in India. The visual effects in *Baahubali* were unlike anything seen before in Indian cinema. Massive CGI armies, beautiful digital environments, and spectacular action sequences — all created by Indian VFX artists — amazed both Indian and international audiences.

Baahubali became the highest-grossing Indian film at the time of its sequel's release and proved that Indian filmmakers could create world-class VFX. After 2015, the entire attitude of Bollywood toward VFX changed. More money was invested, more time was given, and more collaboration with international studios began.

1.4 Purpose of This Study

The purpose of this paper is to clearly show the difference between Bollywood VFX before and after 2015. By studying specific films from both periods,

we want to understand: (a) how the technology changed, (b) how budgets changed, (c) how storytelling with VFX changed, and (d) how audiences and critics responded differently. This paper also aims to highlight what challenges still remain and what steps can be taken to improve further.

This research is important for students of film and media, because understanding VFX history and evolution helps us understand where cinema is going in the future. India is now an increasingly important player in global entertainment, and VFX is a big part of that story.

II. LITERATURE REVIEW

Literature review means looking at what other researchers and writers have already said about the topic. In this section, we look at existing research on VFX in Indian cinema, as well as broader theories of digital effects in filmmaking.

2.1 Theory: What Do Digital Images Do to Cinema?

Film scholar Stephen Prince (1996) wrote about how digital images change the nature of film. In traditional cinema, what you see on screen was something real — a real actor, a real location, a real explosion. But with VFX, what you see may be entirely created by a computer. Prince argued that this changes how we experience films and how we think about what is 'real' in cinema.

This idea is very relevant to Bollywood, because Indian films have always enjoyed exaggeration and fantasy. Song sequences often take place in impossible settings, characters perform superhuman feats, and stories blend mythology with everyday life. According to Dudrah (2006), this 'masala' style of filmmaking is actually well-suited to VFX, because audiences are already used to accepting fantasy as part of the Bollywood experience.

2.2 Early Academic Work on Bollywood VFX

Some of the earliest academic work on Bollywood VFX focused on the science-fiction and superhero films of the 2000s. Goyal (2012) studied *Ra. One* (2011) in detail. He pointed out that while the film had an impressive VFX budget of approximately Rs. 150 crore — which was the highest in Indian cinema at that time — the final product was widely criticized by audiences and critics. He argued that the problem was not money, but rather a lack of experience and insufficient post-production time.

Ganti (2012) wrote about how Bollywood's attempt to globalize led it to hire foreign VFX studios, but that poor communication between Indian directors and overseas VFX teams led to inconsistent results. She described how Indian filmmakers often had ambitious creative visions but lacked the technical knowledge to communicate them effectively to VFX artists.

Prasad (2014) examined the broader technological infrastructure of Indian cinema and found that the country had very few high-quality VFX studios in the early 2010s. Most VFX work was outsourced to studios in the USA, UK, or Australia, and Indian artists were not getting enough experience with large-scale VFX projects.

2.3 The Baahubali Revolution

Baahubali: The Beginning (2015) has been discussed by many researchers as the turning point in Indian VFX history. Subramanian (2016) documented how director S.S. Rajamouli spent years planning the film's VFX pipeline. He worked primarily with Makuta VFX, an Indian studio, and insisted on maintaining quality standards that would hold up to international comparison.

The film's success showed that Indian VFX could compete on a global level. Subramanian also noted that the post-production period for *Baahubali* was unusually long by Bollywood standards — over a year — which allowed VFX artists enough time to refine their work. This became an important lesson for the industry.

Mehta (2020) studied the economic impact of *Baahubali* on the Indian VFX industry. He found that between 2015 and 2019, the number of professional VFX studios in India doubled. Many studios upgraded their hardware and software, hired more trained artists, and began attracting international projects. International productions like Hollywood films and web series started outsourcing VFX work to India, which helped Indian artists gain experience and improve further.

2.4 Post-2015 Films in Academic Research

After 2015, academic interest in Indian VFX grew significantly. Sharma and Nair (2019) analyzed the use of VFX in *Baahubali 2: The Conclusion* (2017) and found that the film improved on the first part in almost every technical area. They noted the increased use of photorealistic water simulation, improved crowd control software, and better integration of actors with digital backgrounds.

Krishnan (2021) looked at Bollywood's increasing collaboration with international VFX companies. He found that films like *War* (2019) and *Brahmastra* (2022) involved partnerships with studios like Framestore, DNEG, and Prime Focus Technologies — companies that have won multiple Academy Awards for VFX. This collaboration raised the standard of Indian VFX significantly.

2.5 Gaps in Existing Research

While many researchers have studied individual films or specific aspects of Indian VFX, there is a lack of studies that systematically compare the pre-2015 and post-2015 periods as a whole. Most studies focus on either one film or one specific technical aspect. This paper tries to fill that gap by offering a structured comparison across multiple films and multiple dimensions.

III. RESEARCH METHODOLOGY

3.1 Type of Research

This study uses qualitative research methods. Qualitative research means we are not collecting numbers or statistics from surveys. Instead, we are reading and analyzing existing material — films, articles, interviews, and reports — to understand patterns and draw conclusions.

Specifically, we used a method called textual and content analysis. This means we carefully watched and analyzed specific scenes from the selected films and compared them based on certain criteria. We also reviewed secondary data, which means information that has already been collected by other sources, such as news articles, industry reports, and academic papers.

3.2 Selection of Films

We used purposive sampling to select six films. Purposive sampling means we deliberately chose films that are well-known and representative of VFX usage in their respective time periods. The criteria for selection were: (a) the film must have notable VFX content, (b) it must be a mainstream release that got significant audience attention, and (c) it must represent different budget levels and genres.

Pre-2015 Films:

1. *Koi Mil Gaya* (2003, Dir. Rakesh Roshan) — This was one of the first Hindi films to feature a fully CGI character. The alien character Jadoo was created using computer graphics. Though the VFX looks

simple by today's standards, it was a big achievement for its time and showed that Bollywood was willing to experiment with digital effects.

2. *Ra. One* (2011, Dir. Anubhav Sinha) — This superhero film had the largest VFX budget in Indian cinema up to that point — around Rs. 150 crore. It used motion capture technology and attempted large-scale digital action sequences. Despite the investment, audience and critical response to the VFX was mixed.

3. *Dhoom 3* (2013, Dir. Vijay Krishna Acharya) — This action thriller used digital effects for stunt sequences and environment extensions. While not a VFX-heavy film compared to the others, it represents how mainstream Bollywood films of that era used VFX — mostly for practical enhancements rather than world-building.

Post-2015 Films:

4. *Baahubali: The Beginning* (2015, Dir. S.S. Rajamouli) — The landmark Indian VFX film. It created an entire ancient fantasy world using Indian VFX studios. The waterfall sequence, the battle scenes, and the digital kingdom of Mahishmati all set new standards for Indian cinema.

5. *RRR* (2022, Dir. S.S. Rajamouli) — A period action-drama that mixed historical fiction with spectacular VFX. The film featured photorealistic CGI animals, massive crowd simulations, and inventive action sequences. It won the Academy Award for Best Original Song in 2023 and gained major international recognition.

6. *Brahmastra: Part One – Shiva* (2022, Dir. Ayan Mukerji) — This was the most expensive VFX project in Bollywood history, with an estimated total budget of over Rs. 410 crore. It was made over several years and involved international VFX studios including Framestore and DNEG. The film created a unique visual style called the 'Astraverse.'

3.3 Analytical Framework

Each film was analyzed across four dimensions:

- (a) Technology: What kinds of VFX techniques and software were used? Was the technology advanced for its time? Were there any innovations?
- (b) Budget: How much was spent on VFX? What percentage of the total film budget did VFX represent? Was the money spent efficiently?
- (c) Narrative Integration: Did the VFX serve the story, or was it just for visual show? Were the digital elements connected to the characters and emotions of the film?

(d) Audience and Critical Reception: How did viewers and critics respond to the VFX? Were there complaints about quality? Did the VFX contribute to the film's overall success?

3.4 Limitations

This study has some limitations. First, we could not access the original VFX files or speak directly with VFX supervisors. Our analysis is based on publicly available information. Second, the six films selected are not a complete picture of all Bollywood films — they are major productions and may not represent average-budget films. Third, quality of VFX is partly subjective — what one viewer finds impressive, another may not.

IV. DATA ANALYSIS AND FINDINGS

4.1 Technological Advancement

Pre-2015 Technology

The technology used in pre-2015 Bollywood VFX films was relatively basic by international standards. *Koi Mil Gaya* (2003) used early CGI animation software to create the alien character Jadoo. The character has a smooth, cartoon-like look that was clearly computer-generated. However, at the time, this was impressive for Indian cinema.

Ra. One (2011) used more advanced tools, including motion capture technology to animate the robot character G. One. Motion capture means actors wear special suits with sensors, and their movements are recorded and transferred to a digital character. However, the integration of this digital character with the real actors and environments was often poor. In many scenes, the lighting on the CGI character does not match the lighting in the real scene, making it look fake. This is called poor 'compositing.'

Dhoom 3 (2013) used relatively straightforward VFX — mostly green screen work and wire removal. Green screen means actors perform in front of a green background, which is later replaced with a digital environment. The VFX in this film was competent but not groundbreaking.

Post-2015 Technology

The jump in technology after 2015 is very clear. *Baahubali* (2015) used a wide variety of advanced techniques. The city of Mahishmati was created using digital matte paintings — large, highly detailed paintings that serve as backgrounds. The battle scenes used particle simulation to create realistic crowd effects. Wire removal was used extensively for the stunt and action sequences.

RRR (2022) pushed the technology even further. The most famous scene in the film involves a massive stampede of wild animals — tigers, deer, wolves, and bears — running through a British colonial city. Each animal was created using advanced CGI with realistic fur simulation and physics-based animation. The scene also required simulating the movement of hundreds of animals at the same time using crowd simulation software.

Brahmastra (2022) used tools and workflows similar to Hollywood's top VFX productions. The film worked with Framestore, the studio behind VFX in *Gravity* (2013) and *Guardians of the Galaxy*, and DNEG, which worked on *Inception* (2010) and *Tenet* (2020). The Astra powers — fire, wind, light — were created using fluid simulation software and custom particle systems. The result was a visual language that felt unique to this Indian film while meeting global technical standards.

4.2 Budget Analysis

Budget is closely related to technology and final output quality. However, spending more money does not always guarantee better results, as the case of *Ra. One* shows.

Ra. One (2011) had a VFX budget of approximately Rs. 150 crore, which was about 40% of its total production budget. Despite this enormous investment — the highest at the time — the film's VFX was widely criticized. The problem was not the amount of money, but how it was spent. The film had an unrealistic production schedule, tried to do too many complex things without enough experience, and hired multiple different VFX studios, which led to inconsistent quality across the film.

Baahubali: The Beginning (2015) had a VFX budget of approximately Rs. 40-50 crore, which is actually much less than *Ra. One*. Yet the results were far superior. This is because the production was well planned, VFX work was done primarily by one studio (Makuta VFX), and the post-production period was much longer, giving artists more time to refine their work.

Baahubali 2: The Conclusion (2017) had a VFX budget of approximately Rs. 100 crore. This was more than double the first film, and the quality showed. The second film had even more elaborate sequences, including a detailed prologue scene showing the history of Mahishmati that involved extensive digital environments and character animation.

Brahmastra (2022) had an estimated VFX budget of Rs. 200-250 crore, making it the most expensive VFX production in Bollywood history. The film was made over 7-8 years, giving the VFX team an unusually long development period. While the film received mixed critical reviews overall, the VFX was almost universally praised.

4.3 Narrative Integration of VFX

Narrative integration means how well the VFX is connected to the story, characters, and emotions of the film. Good VFX should not feel like a separate 'show' — it should feel like a natural part of the world the film creates.

In pre-2015 films, VFX was often used more as an attraction than as a storytelling tool. In *Koi Mil Gaya*, the alien Jadoo is charming and lovable, and is important to the plot, but the film's emotional heart is the friendship between Jadoo and the main character Rohit. The VFX exists to show Jadoo, but it does not really deepen our understanding of the characters or their journey.

Ra. One uses VFX for spectacular action sequences, but these sequences often feel disconnected from the film's emotional core. The CGI fights are impressive to look at (for their time), but they do not tell us anything new about the characters or advance the story in a meaningful way. Many critics noted that the VFX was used more as a marketing tool — to show audiences that the film was 'international' in quality — than as a genuine storytelling device.

Post-2015 films show a very different approach. In *Baahubali*, the digital world of Mahishmati is not just a background — it is essential to the story. The size, grandeur, and beauty of the kingdom tell us about the power and history of the royal family. When we see the kingdom being destroyed and rebuilt over the two films, the VFX becomes an emotional experience, not just a visual one.

In *Brahmastra*, the Astras (magical weapons) are explicitly connected to the main character Shiva's internal emotional journey. His ability to use fire is connected to his own personality and feelings. The VFX literally represents his emotional state — when he is frightened, the fire dims; when he is brave and in love, it blazes brightly. This is an excellent example of VFX being used as a narrative tool rather than just spectacle.

4.4 Audience and Critical Reception

The reception of VFX by audiences and critics is an important way to measure its success. If VFX is done

well, audiences do not notice it — they simply accept the world of the film. If it is done poorly, it distracts viewers and reduces their enjoyment.

Pre-2015 Bollywood VFX received very mixed reviews. *Koi Mil Gaya* was appreciated for trying something new, but audiences recognized that the CGI was not on par with Hollywood. *Ra. One* was actively criticized — even mocked — for its VFX quality in many online reviews. Phrases like 'the VFX looks like a video game' were common complaints.

After 2015, the critical response changed dramatically. *Baahubali* was praised by both Indian and international critics for its VFX ambition and execution. The Hollywood trade publication *Variety* described the film's visuals as 'stunning.' The sequel, *Baahubali 2: The Conclusion*, broke all Indian box office records at the time of its release in 2017, collecting over Rs. 1800 crore worldwide.

RRR (2022) received extraordinary international recognition. The film was appreciated by film communities in Japan, Korea, the USA, and Europe. It was shortlisted for the Academy Awards and won the Golden Globe and Academy Award for Best Original Song. International critics specifically praised the film's action sequences, many of which relied heavily on VFX. The film's success on Netflix further extended its global reach.

Brahmastra (2022) had a divided critical response — some felt the story was weak — but the VFX was almost universally praised. Critics who reviewed the film on a technical level noted that *Brahmastra*'s VFX was genuinely comparable to Marvel or DC superhero films. The film's opening weekend was the biggest in Bollywood history for that year.

V. DISCUSSION

5.1 Key Patterns Observed

Looking at all six films together, several clear patterns emerge. First, there is a consistent improvement in VFX quality from 2003 to 2022. The jump is not perfectly linear — *Ra. One* (2011) was in some ways a step backward from *Krrish* (2006) in terms of how well the VFX served the story — but the overall trajectory is clearly upward.

Second, it is clear that 2015 does represent a real dividing line. The films made before 2015 share common weaknesses: rushed production, inconsistent quality, poor compositing, and VFX used more for marketing than storytelling. The films made after 2015 share common strengths: well-planned pipelines, international collaboration, longer

post-production periods, and VFX that serves the narrative.

Third, budget alone does not determine quality. Ra. One spent more money than Baahubali but produced inferior results. The key difference was planning and experience, not money.

5.2 The Role of Director Vision

An important factor that this study reveals is the role of the director in VFX success. S.S. Rajamouli has been involved in two of the three post-2015 films we studied (Baahubali and RRR), and both are widely regarded as landmark VFX achievements. Rajamouli is known for having a very clear visual vision and for giving VFX teams enough time and freedom to do their best work.

Ayan Mukerji, director of Brahmastra, spent nearly a decade making the film. This long development period — unusual for Bollywood — allowed the VFX teams to experiment, develop new techniques, and refine the film's unique visual language. This suggests that the director's commitment to VFX quality is a critical factor, independent of budget or studio.

5.3 Industry Infrastructure

The growth of the Indian VFX industry as a whole has also played a major role. In 2003, when Koi Mil Gaya was made, there were very few Indian VFX studios capable of handling complex work. By 2022, India had dozens of professional VFX studios, a growing pool of trained artists, and established pipelines for working on both domestic and international projects.

Companies like Makuta VFX, Prime Focus Technologies, and Red Chillies. vfx (Shah Rukh Khan's studio) have built world-class facilities in India. This growth means that future Bollywood films can access high-quality VFX without relying entirely on overseas studios, which reduces costs and improves communication.

5.4 Challenges That Remain

Despite the impressive progress, significant challenges remain. The most important is the quality gap between top-budget and mid-budget productions. While Baahubali and Brahmastra have excellent VFX, the average Bollywood film still uses poorly done digital effects. Many mid-budget films use obvious green screen work, unrealistic CGI characters, and poorly composited shots that distract viewers.

There is also a shortage of trained VFX artists in India. While the number of studios has grown, demand for skilled professionals outpaces supply. VFX education in Indian universities and colleges is still not as developed as it needs to be. Most students who want a career in VFX must seek training abroad or learn through on-the-job experience.

Another challenge is the tendency of some producers to cut VFX budgets late in production. VFX is often seen as a cost that can be reduced when a film goes over budget in other areas. This leads to rushed, low-quality VFX work that damages the final film.

VI. CONCLUSION AND RECOMMENDATIONS

6.1 Summary of Findings

This paper has shown, through the analysis of six carefully selected films, that 2015 was a genuine and important turning point in the evolution of VFX in Bollywood. Before 2015, Indian cinema struggled with VFX — budgets were large but results were often disappointing, due to poor planning, limited experience, and a lack of infrastructure. After 2015, the picture changed dramatically.

The success of Baahubali opened the eyes of the entire Indian film industry to what was possible with proper planning, experienced teams, and a director with a strong visual vision. The films that followed — Baahubali 2, RRR, Brahmastra, and others — built on this foundation and continued to push the boundaries of what Indian VFX can achieve.

Today, Indian VFX studios are working on both domestic blockbusters and international productions. Indian VFX artists are gaining experience and recognition worldwide. The future of Bollywood VFX looks very promising.

6.2 Recommendations

Based on the findings of this study, we make the following recommendations for the Indian film industry and related stakeholders:

1. Expand VFX Education: Film schools and universities in India should introduce or expand courses in VFX, animation, and digital effects. Students should have access to industry-standard software and be trained by working professionals.
2. Create Government Support: Government bodies like the National Film Development Corporation (NFDC) and the Ministry of Information and Broadcasting should create funding programs to support VFX development in Indian films. Countries like the UK, Australia, and Canada offer tax rebates

for VFX production — India should consider similar policies.

3. Allow Sufficient Post-Production Time: Producers should plan realistic production schedules that include enough time for VFX work. Rushing VFX is one of the most common reasons for poor quality. A well-planned post-production period is an investment, not a luxury.

4. Continue International Collaboration: Indian studios should continue to build partnerships with international VFX companies. These collaborations bring new knowledge, technology, and standards to India, and help Indian artists grow professionally.

5. Standardize VFX Workflows: The Indian film industry should work toward standardizing VFX pipelines and workflows, similar to how Hollywood has standard practices. This will improve communication between directors, producers, and VFX studios, and reduce the kind of confusion that led to poor results in films like Ra.One.

6.3 Future Research

Future research should examine VFX in regional Indian cinema beyond Bollywood and Tollywood. Films from Tamil Nadu, Kerala, and other states are also increasingly using VFX, and a comparative study of regional versus mainstream Bollywood VFX would be very interesting. Additionally, a study of how audiences in different countries perceive Indian VFX would help the industry understand its strengths and weaknesses in the international market.

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