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Live video production management

Best workflows and case examples

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Goal oriented and focused management is decisive for successfully producing live video events. Providing high production value and low-risk services is important for sustainable and profitable media business, aiming to compete on the rapidly changing market of digital video services. The purpose of this thesis was to evaluate common video production work-flows and effects of applying standard project management methods in medium sized live video productions.

Applicable management tools were chosen and tested in the scope of a standard live video production, demonstrating how project management can be sufficiently incorporated and leveraged. Since video productions are tightly integrated with technology, technical aspects and risk management are presented from both production and management perspectives.

Two live video productions were executed, where the selected management methods were leveraged. Both productions included a setup of at least four cameras, live video and audio mixing and live streaming to the internet. Successes and failures were documented and used to elaborate on the chosen methods and potential workflow issues. Analysis was conducted to define, how well the presented theoretical aspects matched real world scenarios and production management needs. Finally, lean methods were evaluated and their positive effects in live video productions confirmed.

Executed productions were successfully conducted from start to finish, including planning, production, and post-production phases. In both cases, end products included analysis and edited videos for use through web CDN platforms. Results show that adopting standard project management tools and lean methods in live video productions has positive impacts on both production management quality and end results.

Keywords	media, audiovisual, multi-camera, production, management

Tekijä Otsikko Sivumäärä Aika	Hannes Nachtigall Reaaliaikaisen videotuotannon johtaminen 60 sivua + 1 liite 26.4.2017
Tutkinto	Insinööri (AMK)
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Insinöörityössä testattiin ja arvioitiin yleisesti käytettyjä videotuotannon sekä projektijohtamisen menetelmiä monikameratuotannoissa. Tavoitekeskeinen johtaminen on tärkeää onnistuneiden ja asiakasta palvelevien reaaliaikaisten monikameratuotantojen toteuttamisessa. Korkean tuotantolaadun ja matalan riskin tarjoaminen on kriittistä tuotantotyön jatkumon varmistamiseksi nopeasti muuttuvalla ja paljon kilpailua tarjoavalla mediatyön kentällä.

Soveltuvia johtamisen toimintamalleja ja niiden käyttökelpoisuutta tarkasteltiin videotuotantojen tavallisen työnkulun näkökulmasta reaaliaikaisessa monikameratuotannossa. Koska videotuotannot ovat usein teknologiapainotteisia, käytettävien teknisten ratkaisujen, kuten kamera ja äänijärjestelmät, soveltuvuutta ja riskinhallintaa arvioitiin sekä tuotannollisista että projektijohtamisen näkökulmista.

Insinöörityön osana tehtiin kaksi monikameratuotantoa, joissa soveltuvia johtamisen menetelmiä hyödynnettiin ja tarkasteltiin. Kummassakin tuotannossa käytössä oli vähintään neljä kameraa, joiden kuva leikattiin, taltioitiin ja ohjattiin verkkoon reaaliaikaisesti. Projektianalyysien pohjalta määriteltiin valittujen johtamisen menetelmien toimivuus ja tehokkuus tuotantokäytössä. Tarkastelun kohteena olivat myös lean-metodit, joiden vaikutukset media- ja videotuotannoissa havaittiin myönteisiksi.

Insinöörityön tuotantoprojektit toteutettiin onnistuneesti alusta loppuun, sisältäen suunnittelun, tuotannon ja jälkituotannon vaiheet. Molemmissa tapauksissa lopputuloksena olivat verkkojakeluun soveltuvat videot sekä analyysit tuotantojen toimivuudesta. Insinöörityön tulokset osoittavat, että projektijohtamisen menetelmien tehokas hyödyntäminen reaaliaikaisissa videotuotannoissa parantaa tuotantojen johtamisen ja lopputulosten laatua.

Avainsanat	media, audiovisuaalinen, monikamera, produktio, johtaminen

Foreword

I would sincerely like to express my gratitude towards all the people, companies and associations that have been supporting me during the thesis process.

I would like to thank Metropolia UAS and media technology teachers for inspiration and professional perspective that has guided me in many stages of my studies. I would especially like to thank my thesis supervisor Kari Aaltonen for excellent support and feedback during the writing process. I would also like to thank my former teacher and manager Erkki Rämö for immense project opportunities and invaluable professional insights that taught me so much during my time in Valovirta Digimedia production company. Without the help of Metropolia UAS the two thesis projects would not have happened with such a high technical scope and quality. Allowing students to make use of school's hardware and tools has been of immerse help in developing my professional skills and knowledge on the field of digital video productions.

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Espoo 18.4.2017
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Abbreviations

CAT6 = Category 6 networking cable
CDN = Content Delivery Network
ENG = Electronic News Gathering, also referred to as a TV camera
EQ = Equalizer (audio)
FOH = Front Of House (audio)
LAN = Local Area Network
PA = Public Array (audio)
PAR = Parabolic Anodized Reflector (lightning)
SDI = Serial Digital Interface
TC = Timecode
TV = Television
UAS = University of Applied Sciences

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1 Introduction

The intention of this thesis was to provide an overview and analysis of professional methods and workflows for managing and leading successful medium sized live video productions. This includes productions where at least three cameras are used to form a multi camera workflow. The extent of feasible adoption of common project management tools in video productions is presented and analyzed through both theoretical and case examples. Video productions are commonly considered as heavily practical and task oriented ventures where project management is seldom effectively used. The scope of the thesis aims to show, how project management tools can aid in creation of better live video productions and workflows.

The thesis report is divided into two parts. Part one discusses media project management on a theoretical basis, giving examples of practical, industry standard methods for leading media projects in an effective and goal oriented ways. Project management is considered from the perspectives of different stakeholders and interest groups, such as the service provider, the customer, production crew, and third parties. Aspects, such as project initialization, planning, execution, and closing are covered. In addition to standard tools, lean project management principles and their potential effects are reviewed and considered in the scope of live video production management.

Part two concentrates on case examples which illustrate and exemplify real world production needs, workflows, and risk management of live video productions with real-time video cutting and streaming. The first case example is TEDx Otaniemi 2016 seminar, and independently organized TED event where a medium scale multi-camera and technical production was organized to record and stream the event live. A team of volunteers was combined and trained for the event and edited talk videos published on the official TEDx Youtube channel. Fondia Digiseminar project was done for Fondia Oyj, a Finnish law consultancy company. It was a smaller production than TEDx Otaniemi 2016 but in contrast included different stakeholders, teambuilding, and requirements. Case examples include representations of production phases covering pre-planning, customer relations, technical and team planning, resource and staff management, event production, post- production, and analysis. The second part also elaborates on the tasks and actions taken by the producer during the production phase.

Finally, a set of questions are reviewed and analyzed from a live production point of view. How general project management methods and disciplines apply in live productions and which of these aspects are the most important? Did project management have positive effects on the end products? How to scale from a small live production to a major one and do the same project management principles still apply? This thesis aims to present and explain the complete live video production workflow and provide the reader with an adequate overview of its aspects without requiring previous understanding of media projects and live video production.

2 Why is project management needed?

2.1 What is a project?

A project is a set of defined goals which are executed according to a specified plan, predefined timeframe, and a set of resources. Unlike a process, it has a clearly stated beginning and end time, in which the projects goals and targets should be accomplished. Project objectives, goals and timeframe are dependent on the needs for which the project is created. (Project Management Institute 2017.) A project is usually initiated to generate a predetermined and effective impact towards a problem or demand, and it can include creation of services or products (Furman 2014, 12). In case of video productions, this can mean designing a set of informational videos or delivering an excelling live video production, both which should benefit the customer and be reflected as higher sales or more public visibility. In many cases, the requirements and budget are dependent on the set goals. Elements, such as economic possibilities and available time, can influence the goals and standards for a given project. (Williams 2008, 2).

A project differs from normal work as being a one-time effort to create a desired, predefined outcome (Lester 2006, 2). It has four aspects, which relate to each other and impact the outcome: scope, cost, quality, and time (Figure 1). Changing one of these aspects influences all other aspects and the end result. Changing project goals would lead to reduced cost and saved time, while cuts in budget would most likely be reflected in the quality and scope sectors. In practice, all and any decisions done by the project organization will have an impact on one of these four aspects. (Williams 2008, 3, 127.)

Figure 1: Project balance quadrant. (Williams 2008, 3)

A project life cycle can be considered having the following phases: initiation, planning, execution, controlling and closing (Figure 2). The initiation phase is where project goals and targets are defined between all members and stakeholders. This is the phase where a project team or organization is created. Planning or pre-production stage is where project requirements and details are evaluated and arranged. The execution phase is where the project is carried out to gain the set goals and targets. In live video productions, this means the live event and post-production phases. The control stage is where the achieved results are analyzed and reflected to set goals. Changes are carried out in case the current state of the project does not reflect changes in goals. In case the project has been successful and has met its purpose, the closing stage is conducted, finishing the project. (Williams 2008, 3-4).

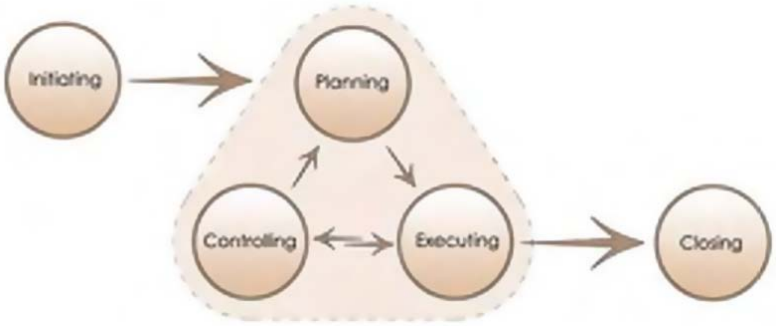

Figure 2: Project life cycle. (Williams 2008, 3)

2.2 What is project management?

A good project is goal oriented and defined in terms of specifications and resource limits. Project management is conducted by a project manager and is a set of necessary actions to keep the project focused, resource-aware and successful. (Furman 2014, 12.) While goals and resources between projects differ based on many variables, they all have elements of risk and uncertainty related to accomplishment and execution. Good project management aims to effectively guide the various aspects, maximizing gains, while minimizing risks and shortcomings. Hence a good project manager is capable of understanding relations between different project aspects, tasks, planning and stakeholders while realizing targets, specifications, and real customer needs. (Lawson 2006, 12-17.)

Effective leadership and management requires both competency and motivation. Project will not be successful without meaningful goals and inspiring project management. (Lester 2006, 6). Successful project management involves combining management, business, and people skills. Project management skills can be considered as tools to steer the project in the desired direction in an effective way. Plans, work breakdown structures and schedules can be considered as tools. Business skills are required to understand why the project is important and how to best serve the customer while considering one's own business goals and revenue targets. People skills are necessary to communicate the needs, targets and means so the project team and all other parties can achieve them in the best ways. (Roeder 2013, 4-7.)

A crucial part of project management is to understand its parties, called stakeholders, that relate to, or are dependent of the project. The project team and stakeholders form a project organization. Stakeholders can be considered ether direct or indirect. Direct stakeholders have a direct control on the project and its outcomes. This includes the client, the service provider, members of the project team and any technical or financial providers. Indirect stakeholders, such as organizational managers, secretaries, or senior management level are not being actively involved in the project organization but are aware of it and minorly affected. Each of the two groups can contain positive or negative stakeholders, depending on their effect on the project. (Figure 3) The process of defining and classifying stakeholders is called stakeholder analysis. (Lester 2007, 27-29.)

Positive stakeholders				Negative stakeholders	
Direct		Indirect		Indirect	
Internal	External	Internal	External	Internal	External
Sponsor	Client	Management	Stockholders	Disgruntled employees	Disgruntled end user
Project manager	Contractors Suppliers Consultants	Accounts Dept HR dept Tech. depts	Banks Insurers Utilities		Pressure groups Unions Press (media)
Project team		Families	Local authorities		Competitors Politicians
Project office			Government agencies		Residents' associations

Figure 3: Stakeholder groups. (Lester 2006, 28)

Good project management is tightly connected to understanding the industry in which management is done. Such understanding comes mainly from working in the specified industry and gaining insights through both personal and company activities. Interpreting the needs of the industry gives a better edge on the market than managing from the perspective of provided services and products. Industries, stakeholders and customer needs change in time, creating opportunities for both growth and failures. A good project manager realizes potential advantages and uses this knowledge to better manage projects and customers, fulfilling both customer and company goals in an effective and innovative way. (Kamensky 2008, 49-52.)

In addition to measuring project success using discussion and feedback between stakeholders, PMP and PRINCE 2 methods can be used to evaluate, how well the defined goals and targets were met. Realization of good project management can be perceived using IPMA Competence Baseline and other similar tools, which provide a structured approach to defining management successes and failures. Use of the tools needs to be agreed at the time of project initiation as this allows their effective use within the project organization. (Findlay 2017.)

Poor project management can lead to problems and issues which can take more time to fix than doing things right from the start. A failing project can cause both financial loss and damage to an individual or a company, the latter being considerably harder to fix than monetary affairs. Every project includes potential risks, even if a similar project has been done in the past. No template for a project can save from errors and culprits as creating a project usually means approaching things in previously unknown ways or having new variables in the objectives or execution. It often means building a new team or

bringing new people to an already existing team. This can lead to social friction through personality or workflow mismatches, jeopardizing co-working. Recognizing other team members and their way of working becomes increasingly important in time and mission critical environments, such as live video productions. A good project manager can detect issues before they can emerge and cause damage to the project. (Williams 2008, 10-11.)

Essentially, project management is a set of different skills and tools which allow to get a project right in every aspect. A great project manager can incorporate such skills and tools to the management workflow in ways that ensures realization of project goals in the best possible way while minimizing budget needs, risks, and resource waste. Good project management will make stakeholders feel safe about the joint venture and ensures that each party is contributing to it by the best of their abilities. (Williams 2008, 3.)

2.3 Live video production overview

A multi-camera live video production consists of several cameras, usually connected to a video mixer for live video editing. Camera work and directing happens in real time and can be accompanied by tasks such as audio mixing, media asset playback, lightning work and stage or studio managing. The event or program can be recorded using cameras, the video mixer, dedicated recording hardware or a combination of these methods for later editing in the post-production phase. The event may also be streamed live over the internet to CND networks or to other parts of the venue. Streaming allows sharing the event to a larger audience than would be possible on the venue. (Millerson & Owens 2008, 53-55.)

While TV live productions for major sports and concert events have been possible for several decades, affordable production of smaller events has been a new development on the field of video services. The biggest reason for this has been the availability of cheaper professional video and audio equipment that has allowed semi-professional and small production houses to enter live broadcast industry. (Schaar & Chou 2011, 3-5.) Live production aims to capture the event or program in an authentic way, giving the viewer the best possible representation of it. In video productions, project management term is usually replaced with production management, to better reflect the industry ter-

minology. Productions vary by size, usually requiring different hardware and crew set-ups. (Millerson & Owens 2008, 50-51.) Figure 4 shows a typical view of a multi-camera setup for a medium sized event including ENG cameras commonly used in TV work, ambient mics for capturing venue sound as well as necessary cabling and rack gear.

Figure 4: A typical view of a multi-camera setup.

Production management begins by stepping into a conversation with the customer after the initial enquiry. A dialog is continued if both sides see cooperation feasible. Customer needs and goals are discussed and verified in meetings and other communication mediums. An important aspect is the ability to educate a novice customer who does not have prior experience with media projects. Aiding in understanding various production tasks, requirements, and pricing, strengthens customer relations, and helps to sell the offer. When the most essential details, such as production scope, goals, timeframe, and budget are set, an official offer can be generated. In case the offer is accepted, a contract is made with all the essential information presented and signed by both the customer and the service provider. (Costello 2012, 76.)

Planning phase begins after production details and goals are defined and the customer has accepted the presented offer. In this phase, all the necessary tools and requirements to produce the live video production are collected, organized, or created. This means

building a production crew, evaluating hardware and technological needs, venue opportunities, creating plans and assets, as well as analyzing potential risks and issues. After careful planning, production takes place where the planned actions are executed and the video and audio assets gathered. The event is recorded live with or without streaming. In case the customer has requested recorded and edited materials, post-production phase is initiated where gathered assets, such as video and audio materials, are combined to create finished videos. Finally, the production is closed if the set goals and targets were achieved. (Costello 2012, 74-75.)

Being a good video production manager does not only require sufficient understanding of management but solid artistic and technical skills to recognize the relation between customer's intentions and actual requirements. Realizing production possibilities and potential culprits allows better risk management and higher production value. Technical expertise and understanding is required to meet production specifications and current professional standards.

2.4 Video production value chain

Every live production has at least two operative sides: the service provider and the customer. The service provider provides media products as a service based on customers' needs and goals. Depending on production scope, nature, and targets, it can also include third party service providers, freelancers, additional customer parties and investors or sponsors. (Costello 2012, 76.) From project managers point of view, it is indispensable to realize each parties function and understand their relations. In project management context, these parties are referred to as project stakeholders, each with their own unique role and function within the production. (Roeder 2013, 3.)

The service provider

A video production can be done from start to finish by a single person, acting as a freelancer or an entrepreneur. More than often however, a production company or creative agency is responsible for managing the production and taking care of the various production tasks, planning and execution. In case of freelancers or one man companies, a single individual will be responsible for customer relations, planning, acquiring media

assets and creating the end-product. The customer and the service provider communicate directly without any middle-men. (Millerson & Owens 2009, 18-19.) In case of production companies, the assorted palette of tasks and assignments are usually divided between different professionals and teams, each managing their own part of the production. This is a necessity due to high workload that would be too big for one person or a small team to control. While this type of segregation is useful and often necessary in bigger productions, smaller projects benefit of condensed teams with less people. As with most processes, more details and parts cause a more error prone system and usually lead to less efficient performance. Producing with a smaller team allows streamlined production and reduces resource and time usage. Since smaller teams are usually faster and more efficient than bigger production teams, many corporate customers look to cooperate with smaller media companies or entrepreneurs for added production quality and more agile workflows. (Riisberg & Soubbotina 2013.)

Entrepreneurs, freelancers, and production companies are not the only service providers for video work. Schools and other educational institutions can provide media services by offering companies and individuals a chance to have their project done as course work. Students get an opportunity to work with real world clients within a scope of a course using school's tools, instruments, and teacher's advice. As the project is done while learning, the client benefits of the deal by having a lower price point for the production compared to hiring a professional. The client may be obliged to pay a small amount of money for the project or can at times receive the work without any cost. The terms and requirements for such productions vary and are dependent on each educational institution's internal practice.

The customer

Potential customers for video productions can be divided into two categories: consumers, such as individual people, and legal entities, such as companies, institutions, schools, associations, and governmental bodies. From a project management perspective, each customer type has their own needs and usually different economic possibilities. The requirements also diverse vastly, requiring different approaches from professionals and media companies who want to offer their services for both customer groups. An individual is usually interested of achieving a personal benefit such as ordering a wedding video filming or letting a professional to edit their family videos. An individual is rarely ordering video services for other people or events. In contrast, legal entities, such

as companies, are mostly interested in gaining profit or visibility among their clients by means of media. They can contact a media company to produce an informal video about an unveiled technology or a commercial video showing the newest product. (Costello 2012, 15-20.)

External parties

Video productions can also include contributors who are not directly related to the production but rather provide the monetary means for it. These can be governmental bodies, other companies interested in a mutual cause, or associations. These stakeholders may or may not have direct control over production goals or specifications but they provide a certain amount of money to create the planned video production. (Furman 2014, 17-18.) It can at times be a challenging task to define, whether a secondary party is acting as a customer or as a project financier only. In this case, it is recommended to collaborate with such a party as if it was a direct customer, setting the primary customer and the external party on the same line of importance. Sponsors on the other hand are generally not considered as being directly involved with the production. (DiZazzo 2012, 7-10.)

A company paying for the production may have their customers or interest groups included, to make sure that vital details are covered. This could mean providing the production company with a research study or other information that outlines specific audience targets and their needs. They may also ask to include candidates of their typical customers in the planning and revising phases. Such actions and details can greatly change the needs of a production and must be carefully considered by the production manager. For example, an educational video targeted at pre-school pupils should not be produced with the same feel and methods as a product demonstration video for corporate customers. Doing so is possible but may render the purpose of the video useless as children are not captivated to follow it or the language used is not effective.

Other service providers can also appear in productions. A customer can order a video production from one company and ask it to be delivered to another company such as a TV-station for screening. A project manager in the production company would need to be in contact with the managing person at the TV-station, ensuring technical compatibility and correct legal workflows. He would also need to be in touch with the customer and inform about the progress and any issues with the TV-station. A video production team could also collaborate with other teams and providers such as marketing specialists,

makeup artists and event coordinators. A production company could also hire freelancers or other media companies to aid with the production. (Lukkari 2004, 79.)

The more stakeholders the production has, the harder it becomes to manage (Roeder 2013, 17). This is one of the reasons why media companies of varied sizes exist. Smaller companies tend to have less staff and resources thus focusing on smaller productions. Bigger media companies usually target more valuable productions as they have more employees, higher number of gear and more resources in their disposal. The differences in customers and productions create a diverse market for professionals and companies, allowing service providers with various capabilities to exist.

3 Customer relations

3.1 Uncovering customer's real needs

The real needs of a customer shall always be the basis for a successful project. Be it a marketing campaign, a promotional video or a live streaming production, the real goals and targets can be determined through dialog and careful analysis of the customers input. The most common first contact with a potential customer comes in a form of an email, which as an enquiry tool is fast and convenient. Making a positive contact from the beginning, enables the best starting point for a production. It is vital to understand that successful customer communication will in most cases yield a long term customer relation as keeping a working cooperation active saves time and resources compared to obtaining a new service provider. Failing to build and maintain good communication and atmosphere can result in losing not one but several deals due to an emerging risk of negative word-of-mouth marketing. (Costello 2012, 77-78.)

At times, customers communicated targets and goals do not necessarily correlate with the real needs. In such cases, professional input is needed to determine the true goals and to correct any false assumptions or misunderstandings. This can be especially true if the case in question is customer's first time working with a production company. A video production may significantly differ from customer's other projects and workflows. This may lead to wrong assumptions about pricing, requirements, contract details or project progress. Customer could request a one minute marketing video which would include script writing, filming and editing, complete with all other production tasks. For such a

project 5000e price tag excluding tax could seem odd and overpriced. After all it would be just a minute-long video. However, this usually means that the customer is not familiar with video production and would simply require explanation of different production tasks and their importance. Educating the customer is considered beneficial as it strengthens relations and will make the customer aware of the production details. (England & Finney 2007, 17-18.)

Bigger productions most commonly include two project managers. Additional managers can be appointed if the production size requires it. One project manager resides on the customer's side. This can be a marketing lead or a communications professional who is making sure that all the necessary information and details of the project are transferred to the production company. Another project manager works on the service provider's end and manages the necessary phases of the project in the production company. In small productions, or productions with a modest budget, producer and project management tasks can be done by a single person. The same person can be the one creating the media product. (Costello 2012, 76.)

3.2 Setting the initial goals

After the initial customer contact, production is initiated by having the first collective meeting between all core stakeholders. The aim of this meeting is to clarify the needs, goals, and available resources to all participants. For the production manager, it is an opportunity to ask questions about customer's intentions and ideas, ensuring that enough information is gathered for budgeting and offer creation. This allows setting most of the goals right from the beginning and helps avoiding misunderstandings that could cause errors in budgeting and feature details. (Lukkari 2004, 24)

Some of the questions which help to define production scope, requirements, and purpose include:

- What is the intended purpose of the production?
- What is the target audience?
- Where does the event take place?
- Should the event to be streamed live?
- Is post editing necessary, are edited videos required for later use?

- Are other technical services such as event audio and lightning managing needed?
- What is the planned maximum budget?

A crucial task before writing the official offer is to calculate the necessary work hours and staff wages, rentals costs and any additional charges that need to be included in the total, offered price for the production. Since no business can run without creating revenue, company profit margin must also be considered. It is common for media productions to require additional work that is not defined in the initiating phase. This means that a realistic overhead should be calculated for the offer, shall the production require more work than first agreed on. This overhead should reflect the real goals and specifications. However, it is easier to reduce the offer price than explain later why production cost was raised or exceeded. A common pitfall in production budgeting is to underestimate the time required for planning and production. This can undercut company revenues and would be considered bad business. Budgeting should also be tied to risk management as it allows to prepare monetary means in case any considerable risks, such as equipment breakdown emerge, causing delays or extra work. (Lukkari 2004, 37-38.)

When the goals and budget proposal are set, it is considerably easier to create a meaningful offer that reflects production goals and specifications. A schedule is usually created to define, when the offer and customer details are presented. This allows smoother workflow continuation and keeps all the stakeholders aware of the requests and timeframes of others.

3.3 Making an offer

After setting production goals, timeframe, and requirements, it is time to create an official offer which the customer can either accept or decline. Customers tend to compare offers from different service providers and choose the one that suits them the best. Price is considered as the key factor in offer comparison. Details, such as offered service quality or quantity, how pricing is presented and fluency in communications all affect customer's impression of the service provider. A clear, easily understandable, and self-explanatory offer assures the customer that the service provider is trustworthy and easy to communicate with. Failing to provide such an offer can lead to a missed deal. (Lukkari 2004, 26.)

A good practice in the offer and negotiation phase is to provide the customer with general terms of video productions. These terms do not replace a production contract but inform the customer in advance of general workflows, requirements, and terms used for video productions. This speeds up the contract creation process when details are clear for both sides and the negotiation process does not start from the ground up. (Lukkari 2004, 65.)

3.4 Contracts and legal obligations

After the customer accepts the offer, it is time to prepare and sign a contract which ensures legal responsibility and liability for both sides. For the customer, a contract is a proof that production will be executed in the given timeframe with set standards, goals, and pricing. For the service provider, a contract is a similar proof that assures payments and ways to proceed in case the customer doesn't pay on time. In that case, the service provider might not hand over finished project materials such as video files. A contract not only provides a clear, concrete overview of the agreed aspects and details but defines exceptions and means for dealing with them. (Lukkari 2004, 67-69)

A typical video production agreement should at minimum include information about contract sides, production specifications, rights, timeframe, and pricing (Table 1). The contract must be signed by both the service provider and the customer to seal cooperation. Starting work prior signing can be dangerous as details have not been agreed yet in a verifiable manner. In theory, an agreement can be verbal. However, proving such an agreement can be ether very difficult or impossible in critical situations such as in a court case. A contract can include appendix covering detailed production schedules, additional terms, and rights transfers. (Lukkari 2004, 70-71.)

Table 1: Basic video production contract terms. (Lukkari 2004, 67)

A contract should include at least these terms:
• contract parties • production introduction • rights and right transfers • production terms • price • schedule and end date, delays • settlement of disputes and analysis details

Copyrights and rights-transfers

A contract should also define how copyrights and right-transfers are conducted. These and related details can also be presented in additional agreements or in an annex to the contract. Copyrighted materials to be used in the production, such as background music, need to be obtained in a legal way that will not cause copyright infringement. Another typical question concerns right-transfers. (Millerson & Owens 2008, 47-48.) Who owns the rights for the raw materials and who for the final product? Complete rights to usage and distribution are usually transferred from the service provider to the customer after the customer pays for the production. Rights to raw materials such as video footage, graphics files and scripts remain with the individual or the company providing the service. A special agreement must be made in case the customer wants to obtain the original assets, used to create the product. However, keeping original materials away from the customer ensures that no second quality assets are visible, keeping the perceived production quality as high as possible. Distribution and usage rights must be defined in the production contract prior any material acquisition or asset creation takes place. (Lukkari 2004, 74.)

Other contracts

In addition to a contract with the customer, agreements with external service providers and rental companies may be necessary. Production may also require a confidentiality agreement in case information provided by the customer or any other stakeholder is classified and should not be presented to anyone outside the project organization. A confidentiality agreement can ether simply state the terms for using classified information, giving the signing party free hands on implementing the necessary methods, or provide requirements and means to deal with such information. (Lukkari 2004, 78-79.)

Defining exceptions and risks

A risk can be defined as uncertainty that might or might not affect the production. As for most projects, it is common for video productions to have exceptions. While avoiding such exceptions is considered best practice, having a logical plan for dealing with unforeseen issues and force majeure -situations helps to lower production risks. It is a necessity which can require careful analysis and evaluation on a per-production basis. In

productions with several service providers or major economic risks, a separate risk analysis is often considered as a requirement. Risk analysis is conducted by the production manager and it defines the risks and means of dealing them. The analysis should state ways of recovering from a problematic situation defined as a risk. Since live video productions include a great number of both technical and management details, proper risk management is essential for maximizing production value and minimizing additional work hours. This in turn allows meeting higher profit margins. (Lukkari 2004, 32-33.)

Risk management can take advantage of different strategies which can be used ether together or separately. Situations can be analyzed on the fly and if a level for risk is exceeded, actions are taken to minimize the risk or its potential effects. A risk does not have to take place as simply a chance for its appearance is being limited. Another option would be not to execute tasks or operations that would include certain risks, thus minimizing the number of risks present in a production. A third option would be to move certain risks to an external provider. A video production company could outsource audio work, including miking and mixing, thus minimizing risks of failure due to lacking in-house expertise. With so many aspects and details, live video productions greatly benefit from good risk management that includes additional plans or workflows for dealing with problematic situations. (Furman 2014, 125-127.)

Dealing with production risks can be particularly challenging for freelancers and entrepreneurs who often lack extensive backup capabilities. Stating service provider's liability in force-majeure situations can save from later claims for compensation. Such cases can include sudden illness, robbery or breaking up of gear, a work accident, or a car crash. Production could halt due the professional not being able to continue or finish the work within the agreed timeframe. For this reason, defining limits for liability is crucial to avoid potential legal issues. The same applies for the customer, who should understand the risks related to video productions.

Additional details

In case of bigger productions, the total cost can be divided into smaller payments which are made after each completed production stage. Previously agreed schedule and terms are used to define and measure progress and when payments for each stage are done. A stage can be considered complete when both the service provider and the customer agree so. The same principle applies for finishing the production. It should be stated in

the agreement that in case the customer is not happy with the result, only a certain percentage of the total cost is billed. Delays in production or due the customer need to be evaluated and defined. An interest rate for each day of an unpaid bill should be defined by ether the contract or applicable laws. (Lukkari 2004, 74.)

It is recommended to use law professional's services whenever production details require so, or one's understanding of the obligatory terms is not sufficient. Setting reasonable and logical contract terms is often a task of the production manager. Only larger production companies or creative agencies can afford to hire a specialist for managing contracts and terms. Such a need may, however, arise in case of a more demanding production which requires considerable focus on agreements daily. (Lukkari 2004, 65-66.)

A good production manager understands the basic structure of necessary contracts and can explain service terms to a novice customer who is not familiar with video production conditions. This shows professional attitude and proves that the project manager is aware of the terms and their meanings. Understanding liability and its importance allows better risk management and preparation regards potential issues within the project organization. (Lukkari 2004, 147.)

3.5 Pricing a project

Video productions can include several tasks and tens or hundreds of hours of work. Knowing the value of this work is important for pricing the project right. The offered price should reflect industry standards for a given project type and work hours used. Current market situation can be determined by evaluating competitors pricing and asking available contacts for their policies. Setting the price too low can make the customer doubt in the provided service and its quality. It can also lead to revenue loss if more work is done than what the customer is paying for. Setting the price too high can lead to a lost deal if a competing service provides a similar service for a lower price. Understanding the balance between project requirements and the work required comes mostly by experience. Pricing is calculated per project by the entire production team or a person designated as the production manager and should reflect the real amount of work done. (Lukkari 2004, 37-39).

3.6 Successful communication

Communicating with the customer and other production stakeholders ensures fluent and efficient workflow. While email is satisfactory for most communications and sharing updates, a call or a meeting is more effective for brainstorming and reviewing progress. Meeting provides a direct opportunity to comment other's ideas and views, allowing dynamic decision making and high productivity. It is best to be an active participant in all discussion and communication channels that relate to you or your team. Understanding the different methods of communication within various interest and stakeholder groups allows choosing the most effective channels and options. If a customer does not respond to emails in a timely manner, meetings or a direct call will be a more efficient way for cooperation and communication. (Williams 2008, 91-97.)

Productions with many different parties require attention to detail to ensure successful communication and workflow. No party should be kept in a data vacuum. This means informing everyone equally and at the same time, thus minimizing risks for error and loss of resources due to inefficient work or mistakes. Stakeholders should also know, when updates can be expected and they should be regular. It is also good practice to be clear about possible exceptions and changes regards production plans and details. (Williams 2008, 113-116.) Online collaboration tools such as Slack can be used in bigger productions with several teams. This allows improved information management and pin point delivery, reducing information overhead for all team members. While sharing information and ideas within a team or an organization can be a good approach, focusing information for only those parties who need it, favors effective and agile production workflow.

4 Video production workflow

A typical video production workflow includes many different phases. It can be divided into three main parts: planning, production, and post-production (Figure 5). Production starts with an idea or a customer initiative, after which the planning phase begins. Production meetings and customer communication defines the scope and requirements for the production. Planning phase is followed by production and post-production phases which rely heavily on proper planning. All the phases are dependent of each other and while usually done in a chronological order, moving backwards in the workflow can happen if production needs or specifications require it. All phases are crucial and must to be

carried out with care. Without proper focus and planning, even a production with great possibilities can fail to deliver the requested outcome. No measure of talent in the production team can suffice poor manager who is unable to plan, evaluate production needs and lead the team. The most crucial need for proper management comes here, as real actions should meet true customer needs. The type of a plan doesn't matter as much as the fact that one exists and successfully addresses production specifications. (Costello 2012, 71-72.)

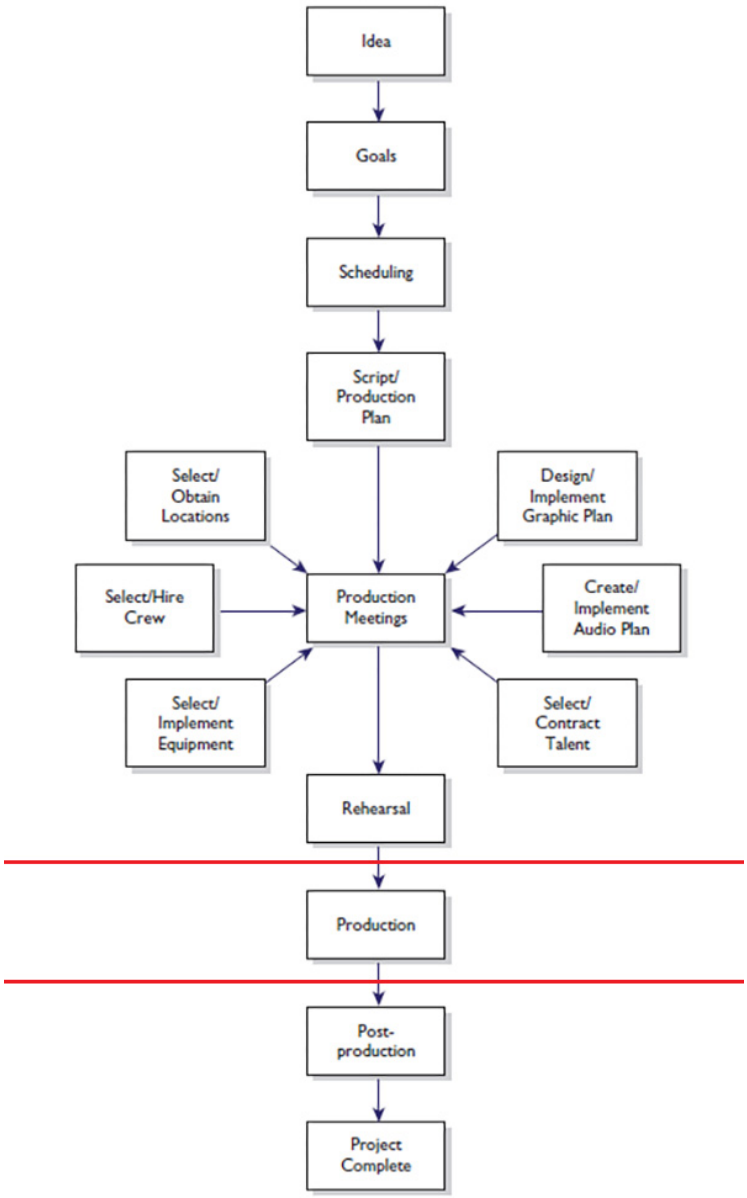

Figure 5: Video production flow. (Millerson & Owens 2009, 44)

4.1 Planning and preparation

Planning, also called pre-production, includes all the preliminaries, preparation, technical prerequisites, teambuilding, scripting, and other tasks necessary to make the production take place. After the initial customer meeting, begins a detailed planning phases which should ensure that all production phases, requirements, and specifications are met in the best conceivable way. The time and effort of careful planning will usually define the success rate and production value of the project. In case of video productions, success indicators include artistic and technical quality, audience acquisition achievement rate and customer satisfaction. Preproduction is expected to establish the scope, goals, direction, schedule, and cost of the production phase before any production means are used. (Costello 2012, 75)

Defining any additional customer requirements, that can emerge from further discussion and meetings, is essential for proper planning. For instance, the amount of covered camera angles and the need for edited videos should be defined during the early stages of planning. If streaming is used, the available services and their technical requirements must be considered in the scope of available hard and software. Streaming in this context means sending the audio and video feed to a web service such as Youtube live, making it available to a broader audience through the Internet (Schaar & Chou 2011, 3). The entire post-production phase can be unnecessary if the customer does not want any edited video materials for later use. This in turn would render any post-production plans irrelevant as the service would not be needed. Removing any unnecessary production phases speeds up planning and the entire production.

A team is unlikely to execute tasks that are not seen as of value. It is important to detect situations where team members are not cooperating and solve these situations by starting a constructive discussion with the team. It is essential to understand that managing a team differs from managing its members, as project management and people management are considered distinctively different subjects with their own methods and tools. (Williams 2008, 12).

Timeframe

A realistic timeframe sets the pace and timing of production tasks. Evaluation of production goals and scope should give a good estimate of the time needed to prepare all the

necessary production resources. It can also be used as a tool to communicate better with the customer, making clear all the deadlines and production phases. A good practice in defining production schedule is to cut tasks into smaller actions. Since tasks can be dependent of each other, scheduling should take this into account and likewise define how late arrivals are handled. Reserving extra time is usually required to ensure that deadlines are met despite any unexpected delays or problems. (Lukkari 2004, 53-59.)

Project management tools, such as Microsoft Project, can aid in planning. It can be used to create production workflow charts and timeframe diagrams such as the Gantt chart. Dedicated project management tools can be of noticeable benefit in bigger productions but their use in smaller projects can create more overhead in the management sector than necessary. In that cases, simpler tools such as Microsoft Office can be used to manage timetables and production details. Tools used should reflect the true requirements and needs of the production scope. (Williams 2008, 60.)

Failing to understand all the requirements and needs of a live video production can lead to undesirable situations where the production fails due to poor planning. It is often said that most of the time in a live video production is used in the planning phase.

The venue

Visiting the venue allows detecting additional requirements regards the production, timeframe, hardware, and team. For example, a seminar event could be held in a venue which lacks reliable wired internet connection. In case the event should be streamed live, it would be necessary to find means to connect the streaming hardware to the internet. In this case, a prioritized wireless internet connection can be utilized. (Schaar & Chou 2011, 313-314.) In another example a venue could be missing proper stage lightning. To have enough light for the cameras and favorable lighting conditions, additional fixtures should be rented and installed at the venue prior the event. (Millerson & Owens 2009, 64).

Locations for setting up cameras and all other equipment, such as audio and video mixers, racks, and supplies, should be found during venue inspection. Understanding in advance, how much room can be reserved for the hardware and the crew, makes planning and production more agile. Cabling routes and potential security concerns should also be addressed. Under no circumstances must any aspects or tools cause a dangerous

situation to people, animals, or property. Production safety is a complex and important aspect, which provides effective ways to deal with potential issues before they can emerge. (Millerson & Owens 2009, 62).

Analyzing the venue and its possibilities gives means to continue planning and cooperate with other service providers. In house audio and lightning engineers should be included in the planning process to make sure their cooperation is aligned with production goals and intended execution of the live event. They can often aid with many questions regarding the venue and its technical services, informing in case the venue can't provide something needed by the video production crew. Rental services can be used to substitute for missing gear or freelancers hired to complete the team. Knowing the venue is the most crucial step in the pre-production phase. Without this information, false assumptions and plans could be generated that can't be executed on-site.

Hardware and rentals

Production scope, requirements and budget often define the hardware suitable for the production. Hardware used in live video productions include ENG (TV) video cameras, video and audio mixers, mikes, wired and wireless communication systems, cabling, lighting fixtures and computers. Additional, dedicated hardware can be used for video encoding, audio and video recording, and streaming. (Millerson & Owens 2008, 7).

A media company is likely to use their own hardware and usually agrees to provide services for productions which comply with the specifications and possibilities of this hardware. Two cameras can be enough for a small company presentation while a seminar or a live concert can require more than four. Since bigger productions require more sophisticated hardware, going from a two-camera setup to four cameras will most likely mean incorporating a professional video mixer. This in turn would require one to be acquired and an additional crew member to operate it. In the end, additional two cameras could mean a cost thousands of euros bigger than the initial production price offer.

Gear rental is necessary if the company or an individual does not have all the required hardware to provide the production in the desired scope or quality. Rentals are usually done several months in advance to ensure that items are available on the needed dates. Insurance details must be checked with the rental company prior renting as not all rentals

are insured by default. Failing to insure the rented gear can lead to direct financial liability should the hardware get damaged or break while in use by the team.

A production manager needs to understand the technical requisites and costs of using different hardware, both company owned and rented. A rudimentary understanding is required at minimum to evaluate productions hardware needs and estimate its impact on the budget.

Team and crew

Team members conducting technical processes at the venue are commonly referred to as the production crew. Most production companies have their own teams for managing and crews for producing events. However, using freelancers is also considered as a widespread practice for filling gaps of in-house teams (Millerson & Owens 2009, 26). Since live productions are critical in all aspects, most crew members have only a single main task to manage. This ensures that a single person can have all the focus on the task in hand, minimizing risks of failure due to dispersed attention. As an exclusion, the production manager and the director will usually have many targets for attention as they need to manage the bigger picture of the production.

A live production crew includes many operating positions (Figure 6). Producer or production manager is leading the entire production cycle. Director is responsible for leading the production phase and giving orders to crew members. Live editing can be done by ether a dedicated editor or in smaller productions by the director. Camera operators are instructed and guided by the director to have the best possible shots and angles. An audio engineer takes care of all the audio mixing and recording functions ensuring the highest possible audio fidelity and suitability for the production. In addition, media playback, presentation technology, lightning or streaming functions can be assigned to additional crew members. In case of any further production needs, the crew may also include assistants who perform secondary tasks, aiding other crew members in doing their job. These can include assistant director, technical director and camera assistants. In productions with tighter budgets, the production team can be responsible for managing venue sound, lightning, and stage operations. (Millerson & Owens 2009, 17-26.)

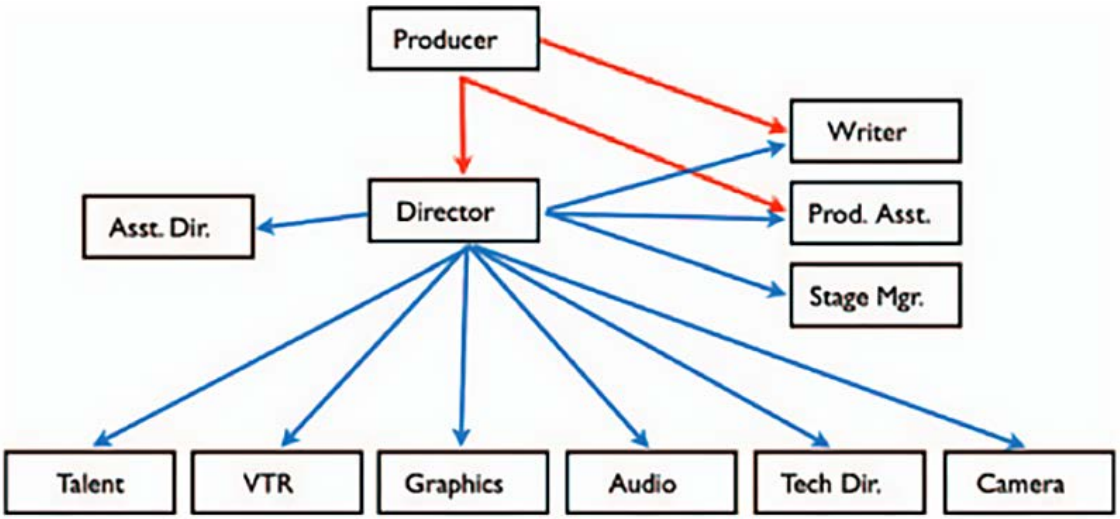

Figure 6: A common video production crew setup. (Millerson & Owens 2008, 19)

Building an effective and trustworthy production crew can be a challenging task in volunteer based events where professional participation is rare. In such cases the production manager should be able to advise and educate volunteers to work within the team using the available hardware and possibilities. At minimum, a professional should be appointed to aid the volunteers in doing so. As skills of volunteers can differ significantly and the members of the crew do not necessarily have prior experience working together, it is advisable to organize team meetings and practicing session before the main event so newly learnt skills can be effectively leveraged.

Plans and scripts

A typical live video production needs a production plan which defines the necessary production phases, details, requirements, and costs. It can also act as a budget, defining how much money is needed for attaining the set goals. A production plan becomes increasingly important in bigger productions where tight budgets and considerable amounts of specifications can become an issue for management if no sufficient plans are done. (Millerson & Owens 2008)

A script is a document which states, what will happen and when during the live event. While most small and medium scale live events are rarely scripted and can be run with a loose program, more complex productions may require meticulously detailed and accurate scripts for efficient workflow. Even a simple script outlining main activities and

their start and end times (Figure 7) is recommended for medium live productions to ensure proper technical execution. Otherwise important moments can be missed due to production crew being unaware of the event flow. A script can be presented ether in a text format or as a storyboard showing different stages. In critical live events, the entire crew has scripts in hand defining their specific tasks at various points of the event. An AV Script format is an effective way to shortly define event moments and crew member's operation during that moment. (Costello 2012, 80.)

RT	ST	Audio	Video	GFX	Music
0:00	1:00		Flash of light	Logo snaps on and off	Music hard hit
1:00	5:00		Series close up body shots of people in motion cut to the music hits		Series of fast music hits
6:00	1:30	Transform Your Body	Blurred Background	"Transform Your Body"	fast music hits
7:00	1:00		Series close up body shots of people in motion cut to the music hits		fast music hits
8:00	1:30	Get Faster Results	Blurred Background	"Get Faster Results"	
11:00	3:00		Series close up body shots of people in motion cut to the music hits		
12:30	1:30	With Simple Steps	Blurred Background	"With Simple Steps"	Music hard hit with echo out.
	2:00	Bring up natural sound	Wide shot of people participating in a Zumba class.		

Figure 7: A simple production script. (Four Steps to Creating an Audio/Video Script, 2014)

Camera and gear setup may also need creation of additional plans, infographics, and connection diagrams in case the crew is inexperienced working together or the scale of production requires detailed documents. Proper plans are necessary to ensure fluent workflows and correct setups which aid the team in understanding, how things should be done and in which order. On-time and safe transportation for both the production crew, other team members and necessary gear ensures that there is enough time for build-up and testing on the venue.

A sample connection diagram for a medium scale live video production is presented in figure 8, showing cameras on the left and a Newtek 3Play 440 video mixer with its control surface in the middle. Secondary hardware, including recording devices and monitoring

screens, are on top. Various output options to streaming services and auxiliary screens are presented on the right side. A connection diagram as any additional documents can effectively communicate required hardware and their connections. A professional video mixer can have a variety of technical properties and options. Hardware should be chosen based on production needs. Choosing equipment that overdelivers by features is not considered cost effective.

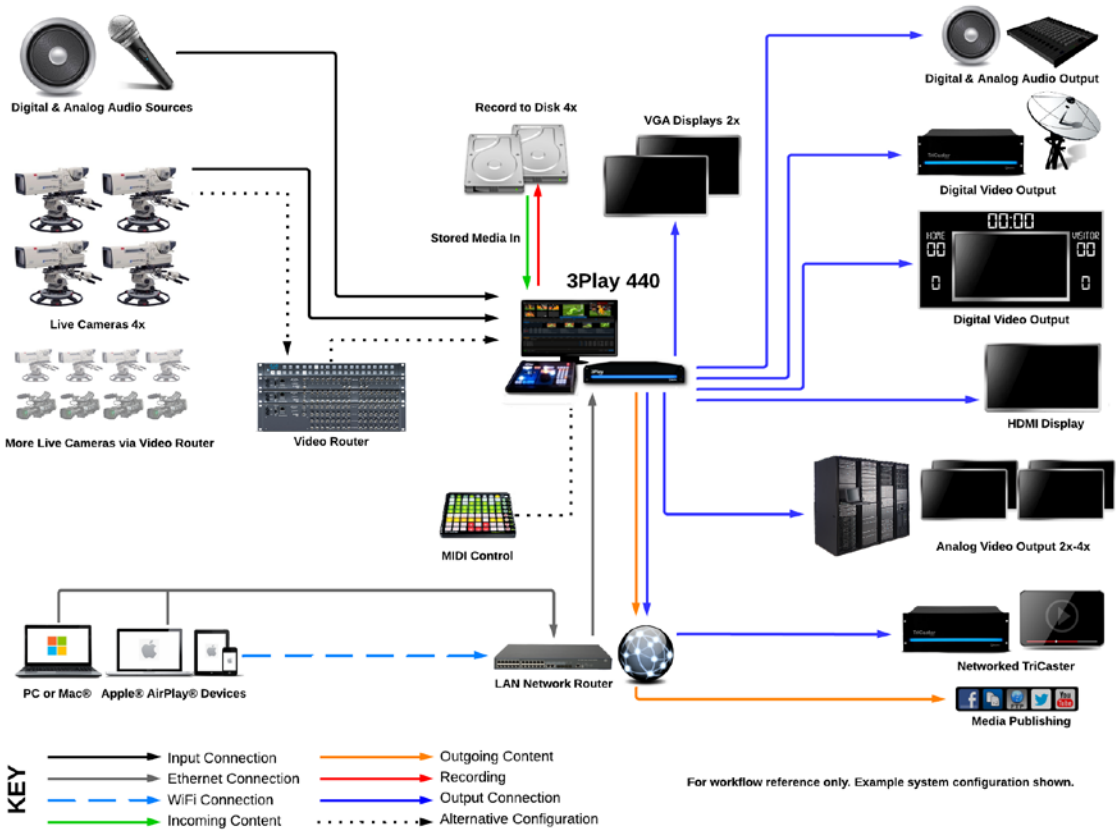

Figure 8: Multi camera system connection diagram. (3Play 440 - System Diagram, 2017)

Production risk management is necessary to evaluate any factors that may negatively impact the production. As a production manager, it is vital to let other crew and team members to know about potential risks and means to minimize them so the entire team is aware of risk free workflows and methods. Documented risk analysis is usually conducted and leveraged in bigger productions. Smaller productions mostly benefit of each individual team and crew members experience and a well-defined and agreed production workflow.

Production managers most important task in the production phase is to effectively communicate production details between the customer and the team, ensuring that goals

and targets are met. All the necessary plans and their availability must be ensured, to provide team members with information and tools they need to do their work. Plans and scripts also help team members to better understand their role and scope of the production. (Millerson & Owens 2009, 19.)

4.2 Production

Production phase is where most of the planned actions take place. In case of live video productions, this means filming the event at the venue and possibly streaming it live over the internet. This phase is the most error prone and stressful for the entire crew, requiring excellent focus and attention to detail. The problem in live events is that most if not all mistakes are easily noticeable in the live stream. This is particularly true in situations where camera operators make changes to framing while being on-air. However, not paying too much attention to mistakes but rather focusing on the production itself helps to deliver a better technical performance. (Lukkari 2004, 20).

In smaller productions, the production manager is usually responsible for leading the production crew in the event, making sure that everything is proceeding as planned. The most important task of the production manager is to verify that all team members have everything they need to do their job and that communication within the team is efficient. In bigger productions, this is part of director's duties. Production manager should also manage customer relations which may appear during the event. (Millerson & Owens 2009, 19) In case of problems, production manager should designate a member of the crew to fix the issue. Under any circumstances should the manager delve to problem solving himself as this could jeopardize the production. In bigger productions, the manager and technical producer can be different people.

Figure 9 presents the most crucial equipment used in live video productions. Core equipment such as audio and video mixers, screens, recording and playback systems and scalers are usually located close to each other in a space that is separated from the rest of the venue. This allows the director to communicate with crew members at the venue without disturbing the event. It also allows more convenient cabling between crucial hardware components such as the audio and video mixer as cable runs are shorter and easier to manage. Problem solving and equipment replacement also becomes easier. Racks

are often used to house different hardware during use and transportation. Cameras are connected to the video mixer by direct cabling.

Figure 9: Live video production hardware setup. (Atem video mixer, 2017)

A director is responsible for guiding camera work during the event and giving orders to the editor who cuts the live feed between cameras. He can also direct audio mixing and media playback if necessary and required by the production scale or budget. Smaller productions with only a few cameras don't usually have a dedicated director and both directing and cutting is done by the same person who also operates the video mixer. (Millerson & Owens 2009, 67).

Bringing the crew and the hardware to the venue, setting up and testing prior the event are production managers most crucial tasks. No prior testing substitutes on-site testing as hardware may get damaged during transportation or setup. While such cases are rare, no chances should be taken when ensuring live production success. All recording systems, including in-camera and external, should be tested. A test stream should also be done in case the event is streamed. In general, all critical systems shall be checked for problems and tested prior going live. Doing proper risk analysis allows efficient risk management during the production phase ensuring low risk and high-quality production. (Millerson & Owens 2009, 66).

Since all the cameras in a multi camera production need to be synchronized in time for later editing, synchronizing must be taken care prior filming. Time Code (TC) can be used to synchronize different cameras to a free running, time of the day format. This means that all cameras are conformed to the same time by accuracy of a hundredth of a second. Video color, format, and acquisition setup needs to be synchronized for a unified look and feel. Failing to synchronize camera settings and Time Code will result in considerably more time spent in post-production phase, leading to inefficient editing workflow and reduced profit. (McDougal 2015.)

Communication during the event mostly consists of ether wired or wireless communication systems which can be used to tie together the entire technical team (Figure 10). Communication systems usually combine a base station and several headsets to form a bidirectional system. Communication is most effectively leveraged in two categories of the production: camera operations and stage management. Camera operations are mostly conducted by the director who gives real time orders to camera operators. This type of communication needs be fast and fluent as it must reflect events course and the possible script in real time. Stage management benefits of real time communication as it allows to inform the production crew of any unforeseen circumstances or situations that may appear off the stage. It also allows the sound engineer to know miking details if miking is done during the event. Without proper communication, even a simple production can fall apart. As the various tasks do not synchronize properly, noticeable errors and mistakes can occur. (Millerson & Owens 2009, 138-140).

Figure 10: Eartech wireless communication system with 5 headsets. (Eartec HUB5S Mini Duplex + UltraLITE Headsets, 2017)

4.3 Post-production

Post-production is the phase where all acquired materials and assets are reviewed and edited together to form a desired set of finished videos which reflect the needs and goals of the customer. In case of a seminar, all talks could be edited separately. On the other hand, a live concert will probably require a different editing style. Editors are usually designated in the beginning of the production and can be part of the live production crew, doing edits in real time. Other media professionals can be included in the post-production phase shall any asset creation needs emerge which the crew members in charge can't carry out. Assets used in the live event can usually be recycled and used again in post-production, saving production time, and lowering costs. This type of assets includes intro, outro, and lower-third -graphics. (Costello 2012, 75-76.)

Editing style and scope is defined by the production plan and script. More specific or bigger productions incorporate separate scripts which include cutting suggestions and requirements. In addition to editing the acquired materials, color grading and audio post-production may take place depending on the desired production quality and price range. Color grading means editing the color reproduction of the video material to ether match different cameras used in production or to improve the overall visual quality of the re-cording. (Costello 2012, 385-386). Audio post-processing aims to improve perceivable sound quality using digital processing tools such as compressors, equalizers, limiters and spectral cleaning (Millerson & Owens 2009, 264). Audio processing can also intend to make the material conform to a specified broadcast loudness standard, such as EBU R128, commonly required in television broadcasting (Loudness normalisation and per-mitted maximum level of audio signals 2014).

Hard drives and cloud services can be used to move the materials and assets. Backups should be made and files delivered to editors by means which ensure file integrity and safety. (Millerson & Owens 2008, 291) Many industry standard professional tools can be used to edit and acquired materials. Avid Media Composer is capable of both single workstation editing as well as collaborating through a cloud system, bringing different editors together to work through a single system. (Media Composer Cloud, 2014.) An-other viable option is Adobe Premiere Pro which also provides a dedicated cloud editing feature that allows several editors to collaborate on the same project without affecting each other's work (Figure 11). Changes and mismatches can be resolved using built in

tools and functionality that allows combining several edits together, forming a finished project. (Collaborate on shared video projects, 2016.)

Figure 11: Visual representation of team editing in Adobe Premiere CC. (Collaborate on shared video projects 2016)

Ability to do many tasks on a single project speeds up the entire workflow as common actions, such as basic authoring, color correction, editing and audio mixing can be done at the same time. In addition, Adobe CC allows dynamic file exchange through Adobe Dynamic Link manager which further speeds up working. For example, Premiere Pro can import Photoshop files without issues and editing the file is directly reflected in the video editing project. (Jao 2015, 4-6). These possibilities are direct time savers and can considerably speed up working. Production manager should ensure that the most effective tools are used and that post-production is carried out by the production schedule and quality principles. Both subjective and objective methods can be used to determine the success of finished video materials.

4.4 Finishing the production

Finishing a production can be considered as important as initiating it. Closing means that no further changes are done and no services are longer provided for the production without reinitiating it, redefining pricing, and targets. Company and team resources can now

be used in other productions and all assets and recordings of the production are usually deleted from all data carriers. Closing a production also allows analysis of outcomes to understand successes and failures that can provide important information for future advancements in workflows and management. It also provides an opportunity to learn, evaluate workflows and strengthen customer relations when the customer understands that the production quality and results matter for the production manager. (Williams 2008, 133-134.)

In case misunderstandings or issues arise, it is wise to refer to agreed terms and details in the production contract, which should clearly state when the production is done. In case no sufficient details are present, fact based and situation defining communication principles shall be used to limit any negative communication forms or legal issues (Pritchard 2013, 176-178.) Discussion and analysis of done work is usually enough to find a good solution to end the production. A service provider can choose to do extra work for a lower price or the customer accepts the done production as-is. In any case, a final report should be made which states what was done and how the set coals were reached. (Williams 2008, 135-136.)

5 Lean methods in video productions

5.1 Definition of lean

Lean project management is a set of tools and methods for optimizing projects and workflows. The idea is to remove any actions that are not necessary, without negatively affecting set goals and targets. In other words, lean is not about reducing the scope or the quality of a project but allows understanding and streamlining project functions and workflows. The lean method was developed in Japan by Toyota to improve their car production processes. Currently it has been adopted in most industries and used in both process and project management. (Kouri 2010, 6-9.)

Lean is not meant to cut budget spending or limit the use of production resources. It also does not mean laying off staff or reducing necessary steps for producing high quality work. Lean aims to provide a straight forward, logical, and focused way of creating value for customers. Lean optimized productions understand customer values, and continuously improve their operations to deliver the best possible outcomes. Eliminating wasted

resources and bloated management in isolated points of production is not as efficient as doing the same for the entire production flow. Improved processes and workflows use less human, monetary and equipment resources. (What is lean? 2017.)

Lean is built around a concept of validating customer needs before a service or a product is conceived. Validating production hypotheses and current state in the context of potential problems, markets and customers, allows detecting issues that could otherwise stay unnoticed. (Klein 2013, 3-7.) Testing and studying current or future services, such as a streaming concept aimed at a new target customer group, allows defining production requirements and potential risks. Prototypes and Pain-Driven Design methods allow testing hypotheses from a customer's perspective prior launch. Customer feedback should not be forgotten as it provides direct and effective ways for improving services. (Klein 2013, 13-20.)

5.2 Lean in media and video productions

Bringing lean ideas to media productions allows user feedback to be observed and incorporated sooner than in traditional, water fall based workflows. Since services are better tailored to customer needs and expectations through efficient communication between production phases, productions are done faster and cheaper. (Lamont 2016.) The core concept of lean can be effectively realized in video productions as they include a wide array of tasks and details that can be optimized. Such tasks include assets creation, gear setup and streaming details. Keeping the customer in the production loop and informing about done, current and next steps allows the customer to evaluate the production needs from their own standpoint. This allows them to better understand production requirements and reflect their own additional needs or concerns more effectively. Changes in plans or additional requirements can emerge due to customer becoming better informed about the possibilities or limits of the production company, crew, or technologies.

Video production companies have traditionally adapted the waterfall method as the primary way of executing productions. Production is initialized based on an idea, then the work done and finally the result reviewed (Figure 12). After initialization and planning, productions follow a task oriented workflow where communication and analysis is minimized. This method is inefficient as it does not allow production to adapt to changing

specifications. The final test comes in the end of the production where the outcome is reviewed. If the final product is undesirable, the entire production has been unfeasible and needs to be abandoned or started from the beginning. (Lamont 2016.)

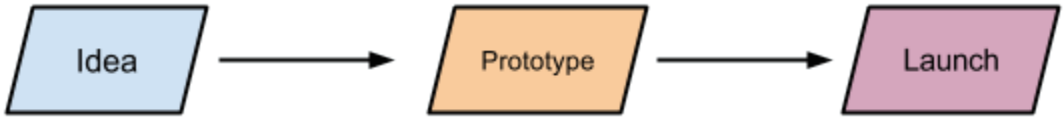

Figure 12: A traditional media project cycle. (Lamont 2016)

Lean media production emphasizes communication and validation between each production task and phase, ensuring that customer needs are evaluated throughout the production lifecycle (Figure 13). Changes and adaptions are possible in all phases of production and care is taken to ensure fluent communication between the customer, production manager and team members. When all production stakeholders understand each other's needs, common goals are met with greater confidence and success. The result will be well determined when the production has been adequately defined and managed throughout its lifecycle. (Lamont 2016.)

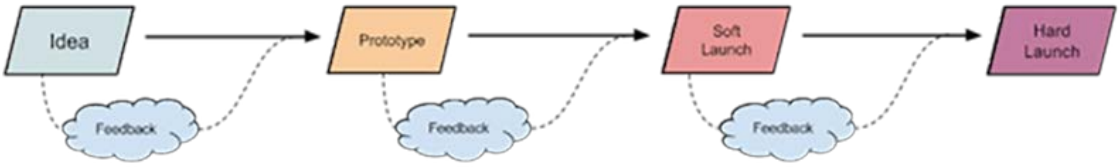

Figure 13: Lean media workflow. (Lamont 2016)

Lean media productions benefit of small, agile teams that can quickly adopt to changing requirements and maximize effective work time by sharing tasks. Producers and teams should avoid processes and tools that are inefficient or unnecessary considering the scope of work and defined production values. Stakeholder feedback and iterative development cycles will ensure cost and resource effective workflow that will benefit all production parties. Feedback can address details such as design, accessibility, aesthetics and pricing. (Lamont 2016.)

An example of a lean driven workflows is soft launch during post-production phase which can be used to check whether the edited results and created media assets conform to customer expectations and fulfill their vision of the production. One or two finished videos

could be sent to the customer for evaluation prior continuing post-production with the rest of the edits. Customer feedback should then be analyzed and commented. Necessary changes in the workflow, assets, editing style and look could be ratified prior finishing all the videos. This would save worktime as the necessary changes in the workflow are done before all the videos have been finished.

5.3 Lean Advantage

Lean Advantage is conceptually more ambitious than other lean methods as it views an entire organization through four different and interrelated aspects or lenses. The four lenses allow efficient analysis of the core areas of video production companies. (Rauchfuss 2010.)

The strategic lens is used to analyze all aspects of the production from the perspective of achieving set goals. It aims to simplify operations and content creation, minimizing potential risks, errors, and overheads. Strategic analysis should rely on quantifiable data rather than managements experience or preferences. The operations lens allows defining and identifying core tactics used to produce video events. Tactics are used to define and reduce the cost and number of resources used for content creation. (Rauchfuss 2010.) This can be achieved by using more rented hardware or freelancers instead of full-time employees, or media assets can be created in a way that allows their fast repurposing and edit for use in other productions.

The people engagement lens outlines logical analysis with creative mindset. Both are needed in production companies as business and operations management should consider artistic aspects and requirements (Figure14). One of the most obvious concerns in video productions is the cost versus quality aspect which is dependent on the time and resource variables of a given production. While costs should be kept to minimum, there is a certain line under which the perceived quality must not fall. The balance between quality and cost is usually dependent on the production crew, management and chosen standards. (Rauchfuss 2010.)

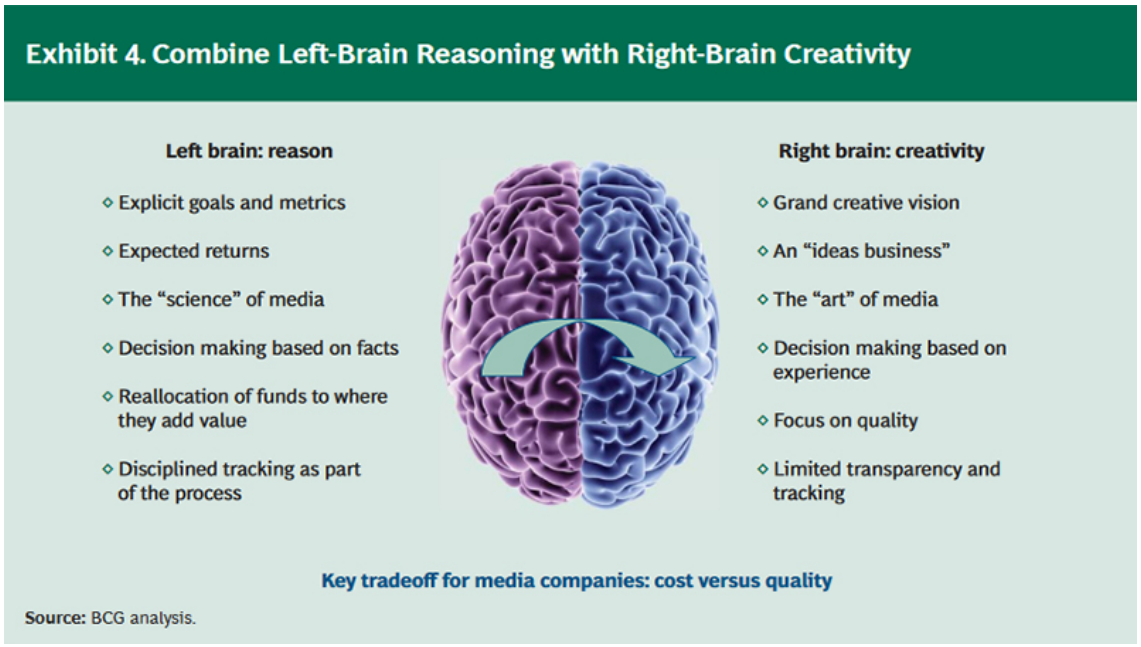

Figure 14:Logical and creative aspects in media productions. (Rauchfuss 2010)

The performance governance lens applies internal accountability tools to measure goal completion. Understanding how to achieve goals and measure success, aids in enhancing workflows. Transparent communication within the organization or team allows bidirectional feedback loop between managers and production members. Lean Advantage can be observed as a workflow enhancing toolset that allows companies and teams to leverage their potential and possibilities better. (Rauchfuss 2010.)

The biggest benefit of Lean for media productions is the ability to keep operations and costs under control, while better serving customer needs and production targets. Lean in video productions is not a widely covered or investigated topic. This provides both new grounds for experimenting and opportunities to research the topic further. As lean has shown to be very effective in all fields on which it has been applied, using lean methods in media and video productions can be considered beneficial.

6 Case TEDx Otaniemi 2016

6.1 Introduction

TEDx is a TED format seminar event which aims to raise collectively important topics and questions, create discussion, and bring together motivated, similarly thinking people.

The entire event is planned and executed by a volunteer based core team and smaller task-driven teams. It is usually sponsored by local schools, company's and societies that are interested in promoting social awareness and wellbeing. The focus of this case study is to elaborate on the workflows and selected production management methods for building a volunteer based tech team, acquiring sponsors, and creating a fully featured technical production for TEDx Otaniemi 2016, held 19. of September 2016 in Otaniemi, Finland. This includes pre-planning, volunteer recruitment, sponsor and gear acquisition, event co-ordination, management, and post-production phases. The workflows and tasks of this production directly outline the ones presented in chapter 4, video production workflow. As the technical director of the event, I started the planning phase four months before the event day.

TEDx Otaniemi seminar was first initiated by Hannu Jaakkola in spring 2015. Back then I was not part of the core team but joined the tech team after being recruited as a volunteer to produce video streaming and help with technical production tasks. I ended up solving most of the technical goals and issues and was requested to be the technical director for TEDx Otaniemi 2016 in May 2016. This time I had both the possibilities and full responsibility in terms of the entire technical production. I also became a member of the core team. My initial task was to create a rough plan of the technical production, set the production value level and come up with a minimum budget that would be necessary to create the production. Without much experience in budgeting productions of this type, I set the budget request at 2000e which was accepted by the rest of the core team. Most of the hardware used in the production was from Metropolia UAS.

Communicating and working efficiently with Core Team members and other teams was important for efficient project management. It was soon realized that most teams related to the tech team in a way or another. Speaker's team had to know about technical specifications of presentation materials and videos to give these guidelines to speakers on our behalf. Slide and video verification was an important step to ensure all presented materials would confirm with set quality standards and that they would work without issues in the main event. On the other hand, venue team requested live translation and thus needed to know if and how this was possible. They wanted to use live translators and provide wireless translation to at least 20 people.

The Core Team met depending on the needs of the planning schedule. Most of the online communication was done using the Slack platform which allowed sending messages and

files in virtual teams in real time. The ability to quickly communicate was of essence and helped all the teams to stay on top of things. Core Team's files and individual production team's files as well as communication was managed separately to keep confidential information out of potentially wrong hands and reduce the information overhead of the event teams. Effective communication ensured that production requirements were up to date and available for everyone.

As the event tied together many different parties, the scope of stakeholders was considerable (Table 2). The core stakeholders were the TEDx Otaniemi 2016 core, volunteer and technical teams, the venue crew, sponsors, and speakers. Positive indirect stakeholders included event visitors and members of the press. Negative stakeholders consisted of various companies that did not agree to sponsor the event and unmotivated team members who could fall out of the production. A risk always stays in volunteer based events that some of the team members stop volunteering. This was also taken into consideration in the technical team.

Table 2: TEDx Otaniemi 2016 main stakeholders.

Positive stakeholders		Negative stakeholders	
Direct	Indirect	Direct	Indirect
TEDx core team Technical team Other volunteer teams Venue crew Sponsors Speakers	Event visitors Corporate and sponsor staff as visitors Press	Parties that did not offer sponsoring Unmotivated team members	Dissatisfied stream viewers People who could not get the event ticket

6.2 The venue

Aalto Design Factory was agreed to be the venue for the TEDx Otaniemi 2016 because of good experience from the 2015 event which was held in the same place. The space used was "The Stage" which could fit approximately 250 people on the floor level, 6 people in the tech area and approximately 10 people on the balcony. The space included a stage area, lighting fixtures, three projectors for presentations and audio-video equipment. A wired 50Mbs internet connection through a separate production network was

also available. This provided a problem free connection for streaming. One of the main concerns when planning a live streaming event is the availability of reliable, high-speed wired internet which is not directly shared with public access networks or wifi hotspots. The reason for this is the need for uninterrupted, minimum latency, high-speed connection, which can sustain single or multiple high bitrate outbound data streams from the streaming computer or a video mixer to the streaming server. Internet connection and its availability was considered as a risk and thus a secondary, mobile internet connection was also planned in case the wired connection would malfunction for any unforeseen reason.

Stage lightning did pose certain problems which became limiting factors for the camera selection. Only four 1KW white PAR lights were available for lighting the stage, other lighting fixtures being colored LED's pointing to the walls of the space. This caused lighting being dark and suboptimal for even a modern EGN (TV) camera. The angle of the white PAR lights was against professional norms causing ugly shadows on the faces of people staying on the stage. Other lighting fixtures had to be rented to fix the lightning problems.

The PA (Public Array/stage speakers) was of moderately low quality and despite main output EQ correction, tended to emphasize room resonances and cause mic feedback. APL technology was used to measure speaker's frequency response and to create FIR correction filters to be used with APL hardware units. This balanced speaker's frequency response and removed many of the problematic room resonances. It allowed easier and more precise sound mixing due to considerably lower feedback level and improved frequency characteristics of the PA, clarifying the high end, and strengthening the mid and low end details. While in most cases such PA correction is out of reach, in this instance it's importance and validity was proven. Speaker systems in different spaces can differ greatly, each having its own frequency and directivity characteristics.

Nonetheless of the problems mentioned, the space was optimal, providing sufficient seating for the audience and room for the cameras and other gear. Thanks to a separate tech area on the back of the space, there was enough room to fit in video and audio mixers, wireless communication gear, mics, and supplies (Figure 15). The information gathered about the venue ensured a sufficient base for hardware and production planning. When venue possibilities were known, crew and hardware decisions could be made in greater detail and precision.

Figure 15: The technical area of the TEDx Otaniemi 2016 event venue.

6.3 Harnessing volunteer power

In the beginning of June 2016, the first official TEDx Otaniemi 2016 recruitment round was started. For the next two weeks, the form was open for anyone interested taking part in the event. All teams were presented, including the tech team. While most teams received many applicants, the tech team barely grasped people's attention. Reasons for this can be many but it might be that technically oriented people were not reached well in channels where the event was advertised. Connections to schools and institutions could have been leveraged better to fill tech team's vacant positions, giving more people the opportunity to join.

I recruited six people through official recruitment and another six through my own connections. Successful teamwork in a busy and error prone environment, such as the tech team, relies heavily on personal professionalism and experience. In case the team members do not have shared work experience, critical situations tend to cause more problems than in a team that has worked in the past. This is due to people not knowing each other's workflows and differences in skillsets. Hence it is crucial to build a strong team, and when

possible, use proven contacts for the most critical positions to ensure error free and efficient production flow in volunteer productions. Crew positions and tasks are shown in table 3.

Table 3: TEDx Otaniemi 2016 technical crew positions and tasks.

Position	Tasks
Technical director	Managing production
Co-director	Aiding in production tasks and setup
Live editor	Cutting live video during the event
Audio engineer	Live and stream audio mixing
Stage manager	Managing stage operations and miking
Lightning engineer	Lightning operations at the venue
Media playback assistant	Presentations management
Camera operators x 6	Camera operations and filming
Postproduction editors x 2	Editing and post-production tasks

After choosing all team members, the first tech team meeting was held where people could meet each other and discussed the initial technical plan. Teambuilding being an important part of a successful event, the tech team also met two times before the event and visited the venue together to brainstorm possible needs and goals for the production that were not yet set. A good stage manager was found through recruitment, who had prior experience of miking and taking commands. This helped the whole team during the event and ensured that stage management was done properly.

A good way to start a production is to analyze past events of a same type, clearly understanding shortcomings and successes. The goal for the 2016 production was to do everything better than in TEDx Otaniemi 2015. This meant better cameras, better mics, more lightning on the stage, professional audio mixing and a bigger team of volunteers. It is said that well planned is half done. This is true in the aspect that proper planning allows to see potential problems before they emerge. It allows greater opportunities to be met through iterating various options and scenarios before carrying out a single action. Since a bigger production also meant more sponsors, the logical next step was to find the necessary sponsors and monetary sources.

6.4 Acquiring sponsors

Based on the pre-plan, I analyzed most of the available rental services, their offerings and pricing. The idea was to find a rental service which could provide the necessary gear and ask them to become sponsors. The agreed 2000e budget for all technical operations was obviously a small amount of money considering the rental costs of professional gear. Good sponsors were hence needed to reduce the rental costs and maximize the production value without breaking the budget. Some companies agreed to be sponsors, others didn't. Some offered a discount on their rentals, others offered the gear for free, in return asking for public visibility in the event. We were more than happy to show our sponsors logos on different forms of print, including name labels and posters, as well as in the outros of the finished talk videos. Offering visibility in volunteer based events is a good way to get sponsors and make valuable connections with sponsoring companies.

First ideas regarding multi-camera setup included using Blackmagic URSA cameras but because their limited availability in Finland, other options had to be considered. Some of the renting companies offered Blackmagic Cinema 4K cameras but due to their lacking performance in low light situations, they were not a good option ether. Bright Oy offered four Sony Full HD broadcast cameras and two robot cameras for rent. However, pricing was too high and well over the 2000e budget. We did, however, manage to get a good deal from them on a wireless microphone system.

Availability was the biggest issue when looking for multi-camera ready cameras. Good options were available but in too small quantities. Since mixing and matching different camera models never works well in a multi-camera setting due to differences in gamma, color reproduction and sensor technologies, I chose to only rent two older Panasonic broadcast cameras from Elokuvapaja that matched the era and specs of five Metropolias cameras. Seven cameras from the same maker and model family allowed to cover enough angles to capture the event in detail.

On-site LED color lights and rented white LED panels set on the edge of the stage were used to fix lightning and shadow issues mentioned earlier. Three scene setups were made in the lightning controller to easily control lightning: all lights off, color LED's on and all lights on. Minimizing lightning controls allowed a single person to also control media playback. This provided an efficient way of using available crew. Old TV cameras still provided good looking image due to added lightning. Each camera angle was later

color graded but the differences were already small due to sufficient set-up prior the event. A two-meter dolly track (Figure 16) and two additional fine movement tripods were also rented. This allowed for smoother motion and less jitter when operating the most critical camera angles.

Figure 16: Dolly track in use in TEDx Otaniemi 2016.

Metropolia's Newtek video mixer with eight coaxial SDI inputs for video and 16 audio inputs on XLR's was used. This mixer had proven trustworthy and capable in many past productions and as a turnkey solution was the best available fit for the production. In addition to mixing seven cameras and a laptop feed of presentations live, it allowed recording all the feeds and four tracks of audio for post-production use. Cutting and most of the operations were done using Newtek's proprietary controller surface which allowed effective and mission critical control. Using well tested and familiar hardware ensured low-risk operations.

In year 2015, headsets were often placed incorrectly at the speakers' head, resulting the mic capsule occasionally hitting cheek and clothing. To gain higher sound quality, better mics and wireless system were needed in addition to doing miking in a professional manner. Back then, we also had problems with mike's going off for brief durations due to radio communication interference and lower quality wireless mic system. An offer for Shure UR flagship wireless microphone system with DPA's 4088 mic capsules was received from Bright Oy for half of the normal price, 750e+tax 24%. I accepted the offer for six channels. This combination ensured a problem free, plug and play wireless audio

transmission coupled with the highest possible sound quality for both FOH (Front of House) and recorded audio.

The biggest tech sponsor for TEDx Otaniemi 2016 was Metropolia UAS which supported us with most of the hardware. We also managed to get an excellent deal from Elokuvakonepaja for the two additional cameras and the dolly track. From Bright Oy, we rented the best-in-range wireless mike system for a 50% off price. Other notions include Suomen Kongressitekniikka which rented us the Sennheiser translation system for free. This proves that in cases of meaningful volunteer based productions, most companies are interested of supporting the cause. It is very common for events such as TEDx Otaniemi to promote the sponsors in various ways, including printed materials, web and video visibility.

Design factory was booked for TEDx Otaniemi 2016 one day before the event. This was essential to build up and test all technical gear prior the event. Without extra time, productions this scale can fail due to unsorted issues with connecting professional production equipment with consumer devices like presenter laptops and on-site venue hardware such as video scalers and network devices. It is advisable to rather have more than less time for preparation. As a technical director, this extra time gave me an opportunity to talk to most of the speakers and remind them about how to behave on-stage. A team practice was run with the entire technical team during this time.

Transportation of the equipment was carried out using a passenger car which resulted in wasted time due to limited space. We did have good timetable for the pickups and a plan on how to set Metropolias gear up while the second round of equipment was being fetched from the rental companies. This allowed the tech team to start setting most of the equipment up saving time later for checking and practice. I had created schematics for both positions and connections of all the equipment and informed the assistant director of the set-up and pre-checks. The list of used equipment can be found from appendix 1. While I was still on my way for the last batch of equipment, the team was already setting up gear marked in the schematic. Good planning and effective teamwork resulted in less wasted time. All the saved time is invaluable and can be used for critical tasks. In this case renting a van would have proved to be a better and more efficient choice than a passenger car.

6.5 The event

My main objective as the production manager was to ensure that the production team was aware of the schedules and tasks to be done prior to the event. I also provided technical knowledge and support for the crew, making sure that everything was going according to the pre-defined plan. In case of issues, I designated one of the crew members to fix it. I also tested the final camera settings, mics, and streaming availability. Live editing area, including the video mixing surface, screens and presentation hardware, is shown in figure 17.

Figure 17: TEDx Otaniemi 2016 video mixing system.

All cameras were checked to have the same settings and all the wire ends were taped to the camera bodies so the cable connections could not move during the live event. A brief disconnection could otherwise happen, resulting in lost sync of the timecode in the recording of a given camera. In post-production, this would have required manual syncing of camera angles causing considerable amount of lost production time. Details such as this can have considerable effect on the production and its resource use. Proper planning and experience was once again of essence, saving time.

Before the event started, a selection of checks and confirmations were run across the team to make sure that everything and everyone were ready to start the show. The final script was received very late, just about half an hour before the event started, causing surprises and errors in the first part of the event due to late arriving information and team's inexperience working together. Another reason was the fact that most of the camera operators and the sound engineer had limited experience working in live events, causing operations being made while the camera in question was still on-air or sound levels being slightly inconsistent in both the FOH (Front Of House) and stream mixes.

Presonus 16.0.2 mixing console was used for doing three separate audio mixes. The first mix was FOH (Front Of House), in other words sound for the venue. The second mix was the live feed audio and the third one a customized mix for the secondary, translated live video stream. While doing three different mixes was bit of an issue for our sound engineer, he still managed to keep everything under control and rare mistakes in mixing were not noticeable. All input tracks were separately recorded trough FireWire on a PC using Presonus software. This allowed more flexible audio processing later in the post-production phase. Two headset mics were designated solely for the events hosts, three for the speakers and one for the translators. In addition, two handheld Shure mics could be used when needed in place of headsets number 5 and 6. For fast recognition, all the input and output channels on the mixer were also labelled using tape. During the event, I communicated the necessary back-stage situation and mic numbers to the mixing engineer so he could be ready to engage the right mixer channels when a speaker would step on the stage.

A combination of wired and wireless communication systems was used to effectively communicate within the team. The system was used to guide camera operators in their framing decisions as well as letting them know, which camera was live at any given time to prevent undesired camera operations on-air. Wireless communication system was used to communicate with the stage manager, ensuring that I and the mixing engineer knew about miking details. When a speaker received a headset mike, the stage manager told me the number of the mike and I in turn told this information to the mixing engineer who, for the purpose of his job, could not carry a communications headset.

Streaming was done by feeding an Elgato capture device with a signal from the video mixers HDMI output. OBS was used on the computer to stream Elgatos signal to Youtube via wired internet. Since we also had a translated stream, two streams were going out of the venue with the same video but different audio tracks. Streaming to Youtube using OBS allowed good stream quality management, automatically generated different viewing resolutions, and use of Youtube's sophisticated CDN network.

All presentation material, including speakers' slideshows and videos, were run from a single Macbook Pro computer with three separate video outputs for projection and video capture. Prior the event, all presentations and materials were checked and confirmed by

the event graphic designer. Effective cooperation ensured that all materials confirmed to set standards and technical requirements.

Both video and audio mixing became more fluid as the event progressed. Me and the live editor were closely cooperating for the first two hours of the event during which I was mainly directing the cuts and he was operating the video mixer. At some point his video cutting and directing became so good that I was mainly focusing on occasionally directing just the camera operations and helping both the sound engineer and the presentation manager in their tasks. I was also directing the stage manager at times where back-stage situations were important to know for the rest of the team. This included the stage manager informing when the next speaker would enter the stage and which mics were used.

In general, the whole production went well and despite occasional stream issues and hiccups, camera work, team communication and audio mixing all worked together forming a seamless production. Problems and issues were later discussed to learn about shortcomings and to avoid errors in upcoming productions. The event lasted five hours. Rented equipment was returned the next working day.

Whenever equipment is taken out of a faculty or a studio, a list of all the equipment shall be made for later checking that everything that was taken out was also brought back to the premises. In case of a lot of hardware, failing to make such a list can lead to items being lost or exchanged with similar equipment of another service provider or the venue. While preparing, testing, and packing equipment at the Metropolia UAS studio, an equipment list was created using a spreadsheet in Excel. This helped to keep a clean track of packed and planned equipment. When the equipment was taken to the venue, the list was used to check the integrity of the equipment selection both when unpacking and packing up after the event. Equipment rented from other sources than Metropolia UAS were also marked on the list the same way. After unpacking all the remaining equipment at Metropolias studio, another check was conducted to make sure nothing was left behind on the venue or in the vehicle used for transportation. Since the list was in an Excel format, a careful but fast check with a laptop in hand was enough to confirm that everything rented was successfully brought back.

6.6 Post-production

Post-production schedule and editors' tasks were defined before the event which allowed editors to match editing with their personal schedules well before editing phase begun. A spreadsheet available in a Google Drive folder was used to designate filmed talks to editors and to mark progress of edits, color correction, audio post-production, rendering and delivery of the videos. Periodic checks were made to track post-production progress and estimate its finalization. One workday was used to copy roughly 700GB of video material from the video mixer to an external drive, ready to be duplicated for the editors. After all the files were copied, the originals remained on the video mixer for the duration of the editing process. Careful checks over data integrity and successful copying is essential when dealing with large amounts of critical data. Backups must be made to ensure that no data is lost because of missing or malfunctioning hardware.

Video material was distributed on two separate hard disks to two editors who both edited most the talks. To speed up editing, I also edited some videos myself. I provided editors with the basic project files with camera angles synchronized using the embedded timecode in each recorded camera stream. After edits were finished, project files were uploaded to Google Drive for me to download and check. Adobe Premiere Pro CC was used for editing and color correction for its efficient workflow and ease of use.

Audio material was recorded by the audio engineer during the event and distributed to me using a cloud service in both processed and raw format. In addition to his processing I applied certain processes to make all the speeches sound more similar and have comparable levels of dynamics, presence, and clarity. Finalized audio was then imported to Premiere Pro and manually synchronized with the video project using waveforms. After every video was edited by the editors, color grading and final checks were conducted to ensure high production quality and similarity between videos. Videos were uploaded to TED's official website for approval. After the approval process was finished, videos appeared on the official TEDx Youtube channel. Both the final masters and the original materials remained on a single hard disk drive as a property of Opin palo association, the organization behind TEDx Otaniemi.

6.7 Verdict

Saying that well planned is half done is very much true in productions of many types. Good and logical planning allowed to meet higher success rates, have smoother operations, and reduce risks throughout the production. As seen in TEDx Otaniemi 2016, many aspects were planned and defined well while others might have required better planning, overall understanding, and smoother teamwork. Being a volunteer driven event, teams consist of both new and usually inexperienced people who are genuinely interested of the cause but lack professional skills. This will always be an important aspect to consider when planning and producing a volunteer based event. Unexpected situations and failures can happen considerably easier than with a professional team. However, this production was a great opportunity to evaluate the chosen project management workflows and methods in a volunteer based event.

Production planning was started well in advance to have enough time for understanding the scope and the requirements of this production. Management methods evaluation continued throughout the production which in total lasted six months. Microsoft Excel and Gantt chart was used to track the production schedule. Excel was also used to list and analyze sponsor offers, available hardware and technical options such as streaming setups. Team communication was done using a combination of meetings, the Slack platform and email. Sponsorships were maintained using mainly phone communications and email. Building and maintaining a personal contact with the sponsors provided to be a good idea and helped to create a better production.

The only contracts made were between the TEDx Otaniemi organizer and rental companies. As this was a volunteer event, no agreements were made with any other parties. Communication and planning could have been done with more emphasis on detail. Some aspects, such as live translation, was not taken care of early enough since a misunderstanding within the TEDx Otaniemi team regards who was responsible for renting the translation hardware. Another issue was the insufficient delegation of tasks at some points of the production stage, resulting in more errors made by me, the technical director due to increased stress. Both delegation and communication issues were addressed in the Fondia production.

TEDx Otaniemi 2016 production was a success despite minor issues with planning, streaming and setup. Post-production workflow could be optimized further, saving editors

time, and reducing technical directors stress. Many of the shortcomings were addressed in the Fondia production, creating a continuous learning and evaluation experience of the project management methods. While being a technical director is a crucial task, it is important to remember that productions require a team of talented and motivated people who are ready to work together for the same goal. Leading such a team as the technical director of TEDx Otaniemi 2016 was an honor and a challenge that taught new aspects and showed a whole new perspective on how to manage and work with people.

7 Case Fondia Digiseminar

7.1 Introduction

Fondia is a Finnish law consulting company that provides services for small and medium businesses. Fondia Digiseminar was a similar type of streaming event as TEDx Otaniemi 2016, the major difference being that unlike TEDx, this production was done for an independent company as a paid service. The core production team remained mostly the same as did the used hardware. Both productions shared the same producer and editors. For Fondia, I was working both as the production manager and director. Since this was a commercial production, it had to be successfully sold to Fondia prior any further planning or actions. Because TEDx and Fondia productions share many similarities, Fondia's case study will focus more on different stakeholder, communication structure and potential issues and successes.

After receiving an inquiry by email from Fondia's marketing presentative, I contacted them for more information. The message included basic information about the event such as the theme, venue, and date. It was also stated that they required a multi camera production with at least two cameras and edited versions of all the seminar talks. We scheduled a phone call to discuss further details and pricing options. Since the event was to be fairly big, two cameras were not going to be enough to cover all the necessary angles and points of interest. Hence, I offered a three-camera production, later changing it to four cameras. This allowed a better-quality production and a more professional looking cutting both in live and post-production phases. This in turn allowed higher production value to be met.

It was agreed with Metropolia that I would combine a team fit for the production, should Fondia accept my offer. This production was a slightly unexpected continuum for TEDx Otaniemi but enabled to redo a similar event with an emphasis on further analyzing live video production management and avoiding the issues faced in TEDx Otaniemi 2016. After making sure that the necessary hardware and team could be acquired, I waited for Fondia to finish their enquiry process and ether accept or decline my offer. The offer itself was written in a simple form as an email. It included information about services and features being offered and a package price for the entire production.

Creating an offer

When writing the offer, I paid extra attention to making it as simple and plain language as possible. A major problem that I realized through analyzing many media company offers is that they are often not focusing on the provided service. Rather they emphasize secondary information such as gear used or work hours. This information is usually irrelevant to the customer. What really matters to the paying customer is the service. In other words, what will the customer get for the money? This reflects the observations done in chapter 2.1 regards the importance of understanding the industry and the product. For this reason, I defined the service in the offer, rather than the means to produce it. This can be observed by comparing the number of technical details to non-technical details in table 4.

Table 4: Fondia Digiseminar offer aspects.

Technical aspects	Non-technical aspects
Four camera production Streaming to Youtube	Total filming time four hours Maximum of 12 edited videos Deadline for edited videos Edited videos provided through a cloud service Additional services such as lower thirds and intro graphics Production schedule and event day confirmation

The importance of creating an offer, which the customer understands, became obvious with Fondia. Their presentative was pleased with the offer which was easy to understand and did not require technical or media related knowledge. All the information needed to evaluate offer details and pricing was presented clearly. After a couple of weeks, Fondia agreed on the offer, so planning and combining the team could be started. Production included several positive, direct stakeholders such as Fondia Oyj, Metropolia UAS and me as the producer. The production crew and the event venue and its technical crew can also be considered as being direct stakeholders as their contribution had a significant effect on the event production. Fonda's customers and partners acted as positive, indirect stakeholders whose requests for streaming and on-stage activities had to be considered.

7.2 Production and post-production

Production was done using a multi-camera setup with four Panasonic ENG (TV) cameras, live video mixing and onsite recording of both audio and video material (Figure 18). The event was streamed live to Youtube using a custom hardware setup. Since there was no wired internet connection present at Nosturi, a phone was used as a USB modem for the computer to send the stream over a prioritized 4G connection. Prioritized mobile internet, which is only available for companies, ensured a lower risk of losing the connection and dropping the stream during the event. Since testing the 4G was successful prior the event, we could be sure that streaming over a wireless network will work. Failing to do so would have been a severe issue. This was also considered in risk analysis.

Setup, testing and production phases were successful. Since less cameras and operations were conducted, the production crew was smaller than in TEDx Otaniemi 2016 event. This helped keeping the production under control better but caused the crew to wait at times at the venue as there were no tasks to be done between setup and event program. Having extra time proved to be important since issues were faced and tackled. Prior risk analysis was very crucial part of production as it enabled seeing arising problems earlier and solving them in effective ways. Since special care was taken to cut the event well live, post-production was faster and more convenient as in the previous production.

Figure 18: Fondia Digiseminar live video mixing screens.

While production manager's tasks remained mostly the same compared to TEDx Otaniemi 2016 production, live cutting, stream audio mixing, and asset playback was all done by the live video editor and no dedicated crew members were used for these tasks. No stage management, audio mixing nor lightning work was done ether as these operations were taken care by the venue crew. This outlines the principles stated in chapter4.1 which states that venue inspection and cooperation with venue's crew is important to define video productions needs and crew composition. Production crew positions and tasks in Fondia Digiseminar are presented in table 5.

Table 5: Fondia Digiseminar crew composition.

Position	Tasks
Production manager	Managing production
Live editor	Cutting live video during the event
Camera operators x 4	Camera operations and filming
Postproduction editors x 2	Editing and post-production tasks

7.3 Failures and successes

Frequent communication with the customer and the team allowed engaging in an effective conversation which leveraged lean thinking and provided positive effects. Keeping all sides of the production aware of the tasks and requirements allowed fine-tuning and streamlining the production till the event day. When the customer understood the core technical concepts and possibilities, their event coordination allowed us to better serve them. Schedules, lower-third designs, and camera setup was all designed with the customer and the venue technicians to ensure that all stakeholders knew about each other's plans and requirements. Failing to do so could have negatively impacted the video production as wrong or no information regards graphics, speakers and possible gear setup locations could have been partially missed.

Despite good communication between the production crew, Fondia and the event venue, certain technical issues appeared at the day of production. Good planning and effective risk management did however ensure that the production was done without any delays and that all the promised services were delivered. Based on later analysis, communication could have been improved, especially regards technical details, and agreed schedules considering venue access.

A presentation laptop was used to show presentations and videos during the event. Contrary to our understanding, the event venue used a picture switcher that did not allow us to feed both the stage projector and our video mixer with the image feed from the presentation laptop using standard SDI cabling, used for video signal transmissions over long distances. A separate signal converter had been rented and there was an additional option to deliver the laptop image and sound to the video mixer over LAN and CAT6 cabling. The latter approach, while requiring additional steps and minor troubleshooting, allowed to deliver laptops feed to the video mixer as promised. This allowed cutting presentations and video material shown via projection to the live stream.

Sound was also an issue since we could not get all the promised audio channels from the mixer. It might however be that in this case there was simply a misunderstanding between me and the sound engineer. This was not a serious issue since audio mixing at the venue was done well and the stereo feed, which we did have, was enough for post-production. However, it would have allowed us to do better audio production, raising

overall production value. Despite certain technical issues, all operations were executed and the production was successful.

Since post production was a major time consumer in the TEDx Otaniemi 2016, Fondia's event was cut live more carefully with the aim of using this edit as a basis for later post-production phase. All the camera angles, the presentation laptop as well as the live-cut stream was recorded in the video mixer. The idea was to synchronize all the tracks in Premiere Pro and making cuts to live-cut version only in parts which needed a more refined edit. Everything else was left as-is. Color correction was also done but only on a global level for each video making sure that the look and feel of the independent talks was consistent and professional. This was necessary due to slight variations in camera settings and lighting during the event.

The new post-production workflow worked well thanks to a good live editor who was capable of delivering on-time, quality cuts. Camera operators also did a good job by staying on top of situations taking place on the stage. After a refined workflow, editing time was cut from 80 hours for TEDx Otaniemi 2016 to just 14 hours for Fondia Digiseminar, saving a massive amount of time. This also made possible of delivering the finished seminar talks to Fondia quicker.

7.4 Verdict

Fondia project gave valuable experience and insights to working directly with a corporate customer and third party service providers. In this project, different stakeholders were analyzed and addressed more throughout compared to TEDx Otaniemi allowing a better starting point and risk management for the entire production. Having backup plans for technical systems, such as the laptop feed, and optimizing prior communication with the venue ensured that all production targets were met. Lean-based customer communication ensured that all the production details ranging from event schedules, streaming conditions, speaker details and graphical guidelines to technical details and setup possibilities were agreed and checked multiple times.

The event and the video production were later analysed by all the core stakeholders and both successes and failures discussed and reviewed for developing each stakeholder's operations. This was a very positive approach as it provided all the parties with valuable

information and strengthened mutual understanding. A few issues, such as the laptop feed and audio misunderstanding, were discussed in detail to understand problem details and to find ways how to avoid such problems in future productions.

Analyzing TEDx Otaniemi 2016 production prior this project gave good ideas about optimizing the production process and allowed considerably faster planning and post-production phases. Overall the project was very beneficial in terms of testing additional project management tools and skills that were not effectively used in TEDx Otaniemi. Scheduling, planning and stakeholder aspects were considered more carefully and technical backup plans were revised. Production and editing workflows were also upgraded using lean-methods, leading to better delegation and task management in contrast to TEDx Otaniemi 2016, where most aspects were being managed my me, the production manager. Leveraging lean thinking and methods allowed to streamline the entire production and cut post-production workload by 80%.

8 Findings and conclusion

Successful management in live video productions includes a variety of aspects, both technical and non-technical. Efficient and goal oriented management using common project management tools and industry standard technical production workflows allowed delivering high-value video productions with a better focus on set goals and specifications. This thesis has tested and elaborated on the feasible ways of adopting suitable project management tools and methods in technology and task oriented live video productions. Project management and video production specific workflows were presented and analyzed from theoretical and practical aspects using case examples and experience collected from productions.

The two case productions were used to evaluate the presented project management and lean methods for both a volunteer based, socially aware event and a commercial production done for a medium sized Finnish consultancy company. Finished productions included 23 edited videos which were distributed using a variety of internet content delivery services. Production schedules allowed workflows and methods to be analyzed separately for each of the two productions. This provided a great opportunity to compare a production done in a rather traditional, task oriented way to one utilizing project man-

agement and lean methods more effectively. The second production, Fondia Digiseminar, showed signs of better management and use of resources due to changes in management principles.

Both projects were done using the standard video production workflow which was tailored for live video events. Production and project management details were adapted to production scopes, requirements, and specifications. As an example, TEDx Otaniemi 2016 production did not leverage contracting phase while Fondia production did. In contrast audio processing in the Fondia production was done by the venue while audio production during the event was a crucial part of TEDx Otaniemi 2016 event. Done productions all leveraged live video mixing using a dedicated video mixer and ENG cameras, commonly used in TV and on-the-field videography. The number of cameras differed but the same filming principles applied.

While production oriented management style allowed effective planning, preparation, and focusing on technical, crew management and task aspects, it lacked adequate tools and workflows for sustainable customer and stakeholder management, industry analysis and workflow improvement that common project management tools and lean methods can provide. Serving customers and stakeholders in the best possible way can be considered as basis for a sustainable video company that respects its customers and production output. The thesis work clearly shows that moving from a production and task focused management principle to a customer and result driven production flow, allows better management routines and more effective work throughout the entire live video production cycle.

Adding lean methods and tools to production management showed further advancement in analyzing and understanding customer needs and production culprits. Such methods scale well between productions of different size but use of each tool and method is recommended only if necessary. Thus, requirements can define the scope of used methods, allowing rationalizing of management by choosing the right tools. Realizing how resources, such as time, money and hardware were used, allowed streamlining most operations, meeting higher success rates and quality values while using less resources and work hours.

The biggest challenge was to bridge the gap between common project management tools and a standard video production workflow used in live productions. This task was

not easy but allowed to experience production management from a perspective not usually presented. Both project management and video production books and information sources exist but finding information about management in video productions proved to be a challenge. Digital media production management books were used to learn about project management on the media field. This information was combined with live video production requirements and information. While lean methods were leveraged and analyzed to an extent, possible effects could be researched further to enhance and streamline live video productions and customer-oriented workflows even further. Based on gathered experiences and analysis, it is recommended to further study project management and lean-method effects in live video productions.

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TEDx Otaniemi 2016 hardware list

Item	Quantity
Video	
Panasonic AG-HPX171	4
Panasonic cam new	1
Panasonic cam wall adapter	4
Panasonic cam batteries	6
Panasonic cam bag	5
Tripod	6
Tripod bag	6
Tripod baseplate	6
HDMI-SDI converter	1
SDI-HDMI converter	1
Panasonic AG-HPX500E+pwr (Mutanen)	1
Panasonic AG-HPX500E case (Mutanen)	1
Panasonic AG-HVX200E+pwr+converter (Mutanen)	1
Panasonic AG-HVX200E case (Mutanen)	1
Tripod+case (Mutanen)	1
Dolly track 2m	1
Dolly track stands	1
Dolly track case	1
Tricaster	
Newtek Tricaster 8000	1
Tricaster control surface	1
Tricaster power cord	2
Keyboard	1
Mouse	1
24" screen	2
DVI cable	2
Screen power cable	2
Audio	

Mic stand	1
Mackie 8ch mixer	1
Mackie 8ch mixer adapter	1
Sennheiser wireless mic set	1
Cardioid mic	2
Mic stand	2
XLRf-XLRm 10-20m	6
XLRf-XLRm 5m	6
XLRf-XLRm 2m	8
XLRm-1/4 plug	8
Shure UR4+ 2CH Base station	3
Shure UR1 bodypack	6
Shure UR2 mic	2
Shure antennas+stands	2
Shure antenna cables	2
Shure power cables	3
DPA 4088	6
Presonus StudioLive 16.0.4	1
Power for Presonus mixer	1
Wirefirew cable	1
Recording PC+Screen+Peripherals.	1
Other	
Extension cord	6
Plastic Box	3